

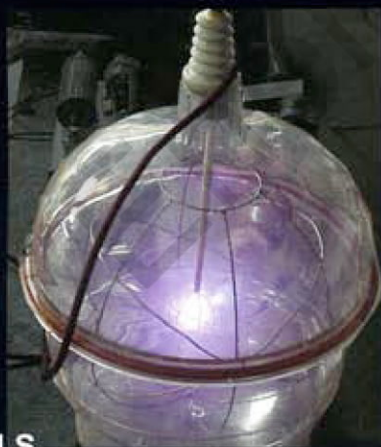
INFINITE ENERGY™

Cold Fusion and New Energy Technology
Now Including Conventional and Renewable Energy

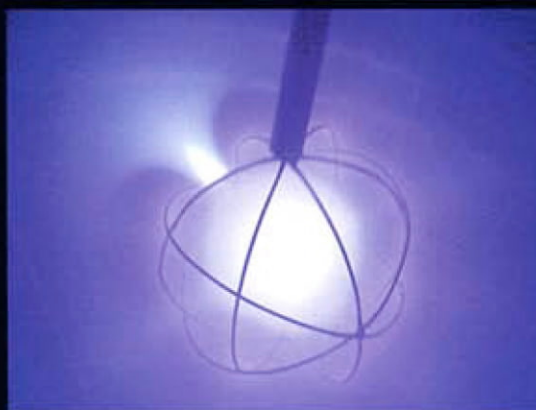
Volume 5, Issue 30 • 2006

The World's Simplest **HOT** Fusion Reactor

Build One Yourself!



\$5.95 U.S.
\$7.95 Canada
£3.95 U.K.



**Scandal in Japan's
Cold Fusion Program—
Positive Results Concealed**



Your Doctor Says You Could Live to Age 100+ and He's Right!

The new science of Anti-Aging Medicine is the fastest growing clinical medical specialty focusing on "optimum wellness and longevity". The *New England Journal of Medicine* has called it the medicine for the next millennium. Already hundreds of thousands of Americans are benefitting from the age-reversing and rejuvenating technologies offered by our physicians.

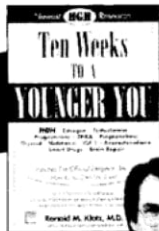
Join the battle against aging!



A nonprofit scientific foundation

FREE!

Receive a complimentary copy of *Ten Weeks to a Younger You* when you join A4M. \$15.95 value.



Ronald Klotz, M.D.
President, A4M

The American Academy of Anti-Aging Medicine, whose membership includes over 7,000 physicians and scientists from 50 countries, is at the forefront of the biotechnology revolution. Keep up with the latest medical advances in controlling and eliminating the diseases of aging.

Join A4M today and receive:

- Free information
- Physician referrals
- Discounts on books, medications, nutrients, seminars, spas and medical programs

Call 773-528-4333

Log on to our award-winning web site:

www.worldhealth.net

"Among the top 15 medical web sites"
Best of the Web, Luckman Internet Yellow Pages

Technology-Oriented Benefactors and Investors Sought for Cold Fusion, New Energy, and New Physics Projects

Contact:

Dr. Eugene F. Mallove

P.O. Box 2816, Concord, NH 03302-2816

Ph: 603-228-4516 Fx: 603-224-5975

e-mail: editor@infinite-energy.com

The Secret of Nikola Tesla:

The Movie

A penetrating study of the life and mind of a "scientific superman," who, against all odds, dedicated his life to the task of designing and improving technology for the service and advancement of humanity.

Starring Peter Bozovic as Nikola Tesla and

Orson Welles as J.P. Morgan

1982 movie, Reissued 1999. Color, 105 min.

\$29.95 North America • \$34.95 Foreign



Cold Fusion Technology, Inc.

P.O. Box 2816, Concord, NH 03302-2816

e-mail: staff@infinite-energy.com <http://www.infinite-energy.com>

Phone: 603-228-4516 Fax: 603-224-5975

Call Infinite Energy for our media kit. 603-228-4516

When contacting our advertisers, mention that you saw their ad in INFINITE ENERGY Magazine

NOW AVAILABLE: BOOK 3 of Cloud Hill's comprehensive series on advanced heat engines

SOLID STATE HEAT ENGINES

By Wayne Proell 308 pages September 1999

This serious scientific study completes our exploration of the efficient conversion of heat to work. It includes indexes for this and the following previous books of this series:

SUPERCARNOT HEAT ENGINES (1984) 439 pp
HIGH EFFICIENCY INTERNAL COMBUSTION ENGINES (1993) 541 pp

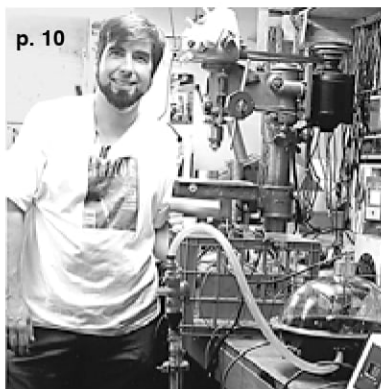
Our newest book comprises two sections: one centers on theory and new designs for thermoelectric, thermoelectric, thermomagnetic, and Maxwellian solid state converters. A second section is experimental and offers extensive laboratory demonstration proving that superperformance can be achieved. The book offers unexploited opportunities for creating working prototypes using common laboratory equipment. These new engines can incorporate your own modifications.

From a friendly reader (C.Gridley, Sudbury, Massachusetts): 'I only wish there were more thought provoking and well written books like this, in the world'

PRICE \$200 FOR EACH BOOK OF THE SERIES Prepayment is required for all books and by all customers. Price includes shipping and handling.

CLOUD HILL PRESS 763 Dora Celeste Drive, Las Vegas, New Mexico 87701 Phone and Fax 1-505-425-9505

Table of Contents - Issue 30, March/April 2000



Tom Ligon with the World's Simplest Fusion Reactor



p. 42



p. 41

Hybrid Gasoline Cars
Renewable Energy on the Internet
Part of new section (pg. 40) on
Conventional and Renewable Energy

FEATURES

- 10 The World's Simplest Fusion Reactor *Tom Ligon*
- 18 My Impressions as a NEDO Guest Researcher at the NHE Laboratory in Japan *Melvin H. Miles*
- 22 Report on Calorimetric Studies at the NHE Laboratory in Sapporo, Japan *Melvin H. Miles*
- 26 The Collapse of the NHE Project *Jed Rothwell*

TECHNICAL ARTICLES

- 48 Sir J.J. Thomson, Transmutation, and the Ether *Paul E. Rowe*
- 51 Effects of Planetary Positions on Transatlantic Radio Propagation: A Fifty-Year-Old Discovery Re-visited (John H. Nelson)
Compiled by Don C. Maier
- 55 The Gravitational Red Shift and Time Dilation *H.C. Josephs*
- 59 Checkerboard Structure of the Nucleus *Theodore M. Lach, II*
- 65 Tornadoes and Ball Lightning *Edward Lewis*
- 67 Technical Note: Suggestions for Improving the Amin Cycle

COMMENTARY

- 34 An Energy Source by Any Other Name. . . *Jeane L. Manning*
- 43 Have We Discovered the "Neno"? *Harold Aspiden*
- 58 Erroneous Predictions in the History of Science
- 64 The Future of Palladium (and Palladium Futures) *Les Case*

DEPARTMENTS

- 4 Breaking Through—Editorial *Eugene Mallove*
- 6 Letters to the Editor
- 9 Beyond the Cutting Edge—Editorial *Jeffery D. Kooistra*
- 36 Briefs
- 39 Calendar
- 40 **New Section**—Renewable and Conventional Energy
 - Hybrid Gasoline Electric Cars Make Headlines *Jed Rothwell*
 - Renewable Energy on the Internet *Peter Glück*
- 44 Book Reviews
 - Voodoo Science (by Robert L. Park) *Eugene Mallove*
 - Voices of the Rocks (by Robert M. Schoch) *Soo Seddon*
 - The Monkey and the Tetrahedron (David M. Jinks) *Jeremy Jones*
 - Great Feuds in Science (Hal Hellman) *Thomas E. Phipps, Jr.*
- 71 Classifieds, Highlights
- 72 Infinite Energy Order Form

Volume 5, No. 30
March/April 2000

Editor-in-Chief and Publisher
Eugene F. Mallove, Sc.D.

Managing Editor
Barbara A.F. DelloRusso

Associate Editor
Jeffery D. Kooistra

Contributing Editors
Jed Rothwell (Georgia)
770-451-9890

Susan Seddon (U.K.)
e-mail: sseddon@infinite-energy.com

Publishing/Editorial Assistant
Christy L. Frazier

Editorial Assistant
Elizabeth Grosser

Scientific Advisory Board

Dr. Harold Aspden
Southampton, UK
Dr. Robert W. Bass
Pahrump, Nevada
Dr. John O'M. Bockris
Texas A&M University (ret.)
Dr. Dennis Cravens
Cloudcroft, New Mexico
Dr. Peter Glück
Institute of Isotopic and Molecular
Technology, Romania
Dr. Xing Zhong Li
Tsinghua University, Beijing, China
Dr. M. Srinivasan
Bhabha Atomic Research Center, India
Dr. Edmund Storms
Los Alamos National Laboratory (ret.)

Infinite Energy magazine (ISSN 1081-6372) is published six times a year by Cold Fusion Technology, Inc., P.O. Box 2816, Concord, New Hampshire 03302-2816. Subscription price: \$29.95 U.S., Canada and Mexico, \$49.95 other foreign. Postmaster: Send address changes to *Infinite Energy*, P.O. Box 2816, Concord, NH 03302-2816.

Infinite Energy magazine presents science and technology, generally in the field of new energy. It provides a forum for debate and discussion of frontier science. *Infinite Energy* is open to all rationally stated points of view. The material presented here reflects the views of the authors, not necessarily those of *Infinite Energy*. *Infinite Energy* assumes no responsibility for individuals who reproduce potentially hazardous experiments contained in its pages.

***Infinite Energy* Magazine**

P.O. Box 2816, Concord, NH 03302-2816
Phone: (603) 228-4516; Fax: (603) 224-5975
staff@infinite-energy.com
editor@infinite-energy.com

<http://www.infinite-energy.com>

Printed in the United States.
Copyright © 2000
Cold Fusion Technology, Inc.
All rights reserved.

**The Planetary Association
for Clean Energy, Inc.**



**A collaborative network of advanced
scientific thinking since 1975.**

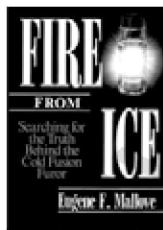
advanced therapeutics
Brown's Gas
consciousness studies
electromagnetic field bioeffects
free energy devices
human rights of scientists
legacy of Nikola Tesla
nuclear and toxic waste decontamination
scalars and the fundamentals of physics

**Sample copy of our Newsletter containing...
... book, video, software & CD-ROM list.**

The Planetary Association for Clean Energy, Inc.
100 Bronson Avenue, Suite 1001
Ottawa, Ontario K1R 6G8, Canada
(613) 236-6265; fax: (613) 235-5876

**Cold Fusion and
New Energy Lectures**

by *Fire From Ice* Author
Dr. Eugene F. Mallove
Editor-in-Chief
Infinite Energy Magazine



Generate lots of excess heat (and new thinking!) in your scientific, engineering, business, civic, or religious organization.

Phone: 603-228-4516
Fax: 603-224-5975
editor@infinite-energy.com

**Fusion Information
Center CD-ROM**

\$49.00 All Locations
Over 2900 pages covering
50 documents or issues.
The CD-ROM contains

Full Text Documents

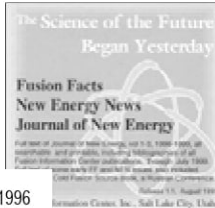
Fusion Facts: July 1989-Dec. 1990, Dec. 1996
Journal of New Energy: Jan. 1996-Fall 1998
Cold Fusion Source Book: May 1996, 313 pp.
New Energy News: Jan. 1997-Nov/Dec 1998

Bibliographies

Fusion Facts: July 1989-Dec. 1996
Fusion Facts Abstracts: Jan. 1996-June 1999
Journal of New Energy: Jan. 1996-Spring 1999
New Energy News: May 1993-May/June 1999

Order from:

Cold Fusion Technology
P.O. Box 2816, Concord, NH 03302-2816
Phone: 603-228-4516 Fax: 603-224-5975
<http://www.infinite-energy.com>



The document files are searchable by key words and phrases using the Adobe Acrobat Reader 3.0.1 with the search engine option which is provided with the FIC CD-ROM package as a separate disk. Adobe Acrobat Reader 3.0.1 included

Contact Infinite Energy for our new media kit. Support Cold Fusion and New Energy Technology with your ad.
603-228-4516, staff@infinite-energy.com

Electric Spacecraft

Journal Network

Keeping you informed about independent research...



The ESJ Network assists individual research efforts, facilitates cooperation among experimenters and provides an open forum for the exchange of information and ideas.

The Network welcomes those engaged in experiments, analysis, conceptual thinking, and investigative research, who are willing to interact with others. Inquiries to: 828-683-0313 or 828-683-1280, Fax: 828-683-3511; **Subscriptions:** [quarterly] *Electric Spacecraft Journal*, 73 Sunlight Drive, Leicester, NC 28748 U.S. annual subscription rates: \$24; Canada and Mexico \$29; Overseas \$39.

NEW Books Available from Cold Fusion Technology

Earth Under Fire: Humanity's Survival of the Apocalypse

Paul LaViolette, Starlane Publications, 1997, Hardback, 405 pp.

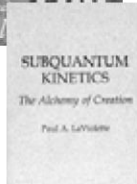
\$28.95 North America/\$36.95 Foreign



**Subquantum Kinetics:
The Alchemy of Creation**

Paul LaViolette, Starlane Publications, 1994
Paperback, 212 pp.

\$18.00 North America/\$24.00 Foreign



**Dark Matter, Missing Planets
and New Comets: Paradoxes
Resolved, Origins Illuminated**

Tom Van Flandern, North Atlantic Books, 1993, Paperback, 514 pp.
\$25.00 North America/\$30.00 Foreign



All prices include shipping and handling.

Order From: Cold Fusion Technology • P.O. Box 2816 • Concord, NH 03302-2816
Phone: (603)228-4516 Fax: (603)224-5975 www.infinite-energy.com

BREAKING THROUGH

Science, Scientism, and Meaning



by Eugene F. Mallove, Sc.D.

Some late-breaking news to introduce this reflection about some larger, related questions: On February 15, 2000, the United States Patent and Trademark Office (USPTO) granted U.S. Patent 6,024,935, "Lower-Energy Hydrogen Methods and Structures," to Dr. Randall L. Mills *et al.* of BlackLight Power, Inc. Some sixty-pages long with 499 claims, the patent appears comprehensive in its discussion of "Methods and apparatus for releasing energy from hydrogen atoms (molecules) by stimulating their electrons to relax to quantized lower energy levels and smaller radii. . . than the 'ground state' by providing energy sinks or means to remove energy resonant with the hydrogen energy released to stimulate these transitions." See previous *Infinite Energy* story about BlackLight Power, *IE* No. 29, pp. 40-41.

Thus is another battle won in the quest for new energy technology. Historians of science will eventually note that it was from corporate activity and in patent literature, not in the obstructionist mainstream science journals and government agencies, that this revolution came into increasingly high profile. It is tragic, however, that the Pons and Fleischmann cold fusion patent application, of equivalent merit and import to the landmark Mills patent, was long ago killed inappropriately by the USPTO.

Another bit of breaking news: Thanks to the good offices of Sir Arthur C. Clarke, who was asked to prepare an essay for President Clinton on future prospects for humankind, to be delivered to the President in early March, this Editor was asked by

the White House Office of Communications to submit a separate essay on the status of cold fusion and new energy. This was done. We were informed that our seventy-minute video, "Cold Fusion: Fire from Water," would also be given to the President. We hope that he watches it.

The 8,000 word manuscript plus Executive Summary, "The Strange Birth of the Water Fuel Age: The Cold Fusion 'Miracle' Was No Mistake," is to be included in the President's book—along with some forty other essays about the future, submitted by notables and the not-so-well-known, such as yours truly. Among the recommendations set forth in my essay is the key one at the end of the Summary: "Mr. President, you need do only one thing now: Publicly state that you are going to investigate this matter and then do it." I do not expect that this essay will either have the intended effect or the historical significance of Albert Einstein's letter to President Roosevelt on the prospects for military use of nuclear energy. But if the account were given serious consideration, it could be a landmark on the tortured path to the Water Fuel Age.

Albert Einstein wrote in another letter, to Queen Elizabeth of Belgium in 1932: "One has been endowed with just enough intelligence to be able to see clearly how utterly insignificant that intelligence is when confronted with what exists. If such humility could be conveyed to everybody, the world of human activities would be more appealing." I was so fond of this sentiment, and still am, that it became the opening to *The Quickening Universe: Cosmic Evolution and Human Destiny* (St. Martin's Press, 1987), the first book I was privileged to have gotten published.

In 1953, Einstein also wrote, "Whoever undertakes to set himself up as judge in the field of Truth and Knowledge is shipwrecked by the laughter of the Gods." This is a wonderful observation about the nature of human life,

a precept not always easy for any of us to fix firmly in mind—especially when we come to believe that our world view is correct in many or in most ways.

Though some people may conclude from experimental evidence that Einstein's relativity theories are flawed at a fundamental level, despite their fortuitous efficacy within some experimental and observational regimes, we can certainly be big enough people to separate Einstein, the philosopher, from the caricature of virtually infallible physics genius that others have created. It is my impression that Einstein, were he alive today, would be appalled at the "deification" of his life and person, such as the designation of him as "Man of the Century" by *Time* magazine.

People who evidently do not share Einstein's humility before "what exists" have been very strident in their attacks on the scientific investigation of cold fusion and new energy. One of them, Dr. Robert Park of the American Physical Society, has a book that is about to be published, *Voodoo Science: The Road from Foolishness to Fraud*, which we review in this issue (p. 44). (Oxford University Press informed us in early March that publication has been "indefinitely delayed.") He calls cold fusion a scientific fraud. Park writes that the role scientists are supposed to play is to "take the strangeness out of the universe." At another point, almost contradicting himself, he suggests that cosmic evolution is "perhaps the strangest thing about the universe. Strange and very wonderful."

Contrast this confusion and arrogance with Einstein's sentiment: "Possibly we shall know a little more than we do now. But the real nature of things, that we shall never know, never." Though Einstein was not a religious man in the sense of adhering to the precepts of an organized religion, in my view he was profoundly religious in that he was imbued with deep spirituality—a sense of wonder coupled with a sense of humility that we would never understand all of existence. He wrote in 1955, "I want to know how God created this world. I am not interested in this or that phenomenon, in the spectrum of this or that element; I want to know his

thoughts; the rest are details."

Einstein also wrote in one of his most famous passages, "Science can only be created by those who are thoroughly imbued with the aspiration toward truth and understanding. The source of this feeling, however, springs from the sphere of religion. To this there belongs the faith in the possibility that the regulations valid for the world of existence are rational, that is, comprehensible to reason. I cannot conceive of a genuine scientist without that profound faith. The situation may be expressed by an image: Science without religion is lame, religion without science is blind."

A contrary view comes from Prof. Steven Weinberg, Physics Nobel laureate, who wrote in *The First Three Minutes* (1977), "It is very hard to realize that this is all just a tiny part of an overwhelmingly hostile universe. It is even harder to realize that this present universe has evolved from an unspeakably unfamiliar early condition, and faces a future extinction of endless cold or intolerable heat. The more the universe seems comprehensible, the more it also seems pointless." This arrogant certainty about existence one might expect from one who authored a popular book titled, *Dreams of a Final Theory* (1992). In a recent *New York Times* article Weinberg wrote, "Spirituality—I don't even know what it means." ("Physicist Ponders God, Truth and 'a Final Theory,'" January 25, 2000.) *Times* writer James Glanz commented, "He (Weinberg) sees no redeeming value in religion and considers it nonsense."

Emphasizing the supposed superiority of his world view, Weinberg wrote in another venue: "One of the great achievements of science has been, if not to make it impossible for intelligent people to be religious, then at least to make it possible for them not to be religious. We should not retreat from this accomplishment." (October 21, 1999, *New York Review of Books*.)

But Weinberg hasn't lived up to the most elementary precepts of science, which is to say, he has not evaluated experiments before making a faith-based assertion about a class of phenomena of overarching importance to physics and society. He mixes attacks against religious beliefs—such as the belief in "miracles"—with his lack of "belief" in cold fusion: "There do not seem to be any exceptions to this natural order, any miracles. I have the impression that these days most theologians are embarrassed by talk of miracles, but the great monotheistic faiths are founded on miracle stories—the burning bush, the empty tomb, an angel dictating the Koran to

Mohammed—and some of these faiths teach that miracles continue to the present day. The evidence for all these miracles seems to be considerably weaker than the evidence for cold fusion, and I don't believe in cold fusion. Above all, today we understand that even human beings are the result of natural selection acting over millions of years of breeding and eating." (October 21, 1999, *New York Review of Books*.)

The like-minded Sir John Maddox, former editor of *Nature*, made a similar inappropriate attack in an editorial, "Defending science against anti-science" (*Nature*, Vol. 368, p. 185, March 17, 1994): "... it may not be long before the practice of religion must be regarded as anti-science." It is worth noting that Maddox played a critical role in the anti-cold fusion bigotry of 1989-90. He is famous for his ill-considered remark in 1990 about cold fusion, "Broadly speaking, it's dead, and it will remain dead for a long, long time."

It seems to me that Einstein spoke directly to the mental confusion of such "believers" in scientific materialism as Weinberg and Maddox with their concomitant disregard for fundamental scientific principles, such as unbiased investigation of frontier science: "And here lies the weak point for the positivists and professional atheists, who are feeling happy through the consciousness of having made the world not only god-free but even 'wonder free.' The nice thing is that we must be content with the acknowledgement of 'wonder' without there being a legitimate way beyond it." Einstein wrote this in a letter to a friend in 1952.

Weinberg and Maddox are part of what seems to be a little-discussed, quasi-covert twentieth century "religion" known as "Scientism." Adherents of scientism are convinced that within the *established* scientific community resides by far the best, most reliable description of existence. Believers in Scientism consider that religion, spirituality, and "pseudoscience" (which includes everything from cold fusion to ESP research to UFO investigations) are the prime dangers to humankind (never of course *their* science and philosophy). They are further convinced that the world is composed of *only* matter (whatever *that* is!) and electromagnetic radiation in a space-time plenum, and that all of existence and consciousness can be reduced to *existing* physical laws governing these. Even if they were correct about the latter, their religious zeal in excoriating any other possible cosmologies is offensive and, in fact, unscientific.

Science, not Scientism, should govern our actions in investigating all of exist-

tence. Science, with a capital letter, gives meaning to life. Scientism, when decomposed to its basic elements, is fundamentally a covert "religion"—one, ironically, that denies the efficacy of reason.

Steven Weinberg's remarks on a 1994 BBC "Heretic" series television program about the continuing laboratory parapsychology work of Princeton University Professor Robert Jahn (former Dean of Engineering) and others there, including a physicist, is a noteworthy flight from reason. Weinberg tells the interviewer: "It would overturn all the centuries of work since the birth of the modern era at the end of sixteenth century. Those centuries of scientific work have given us a picture of nature—we understand why things are the way they are. We understand them in a way that doesn't put human consciousness in any special position. Parapsychology, if there was anything to it, would undo those centuries of effort and we would be back at the beginning without any real idea of what kind of world this is that we live in." Weinberg, like Maddox, is incapable of admitting *any* fundamental extension of scientific understanding. He suggests illogically that all past knowledge would have to be overturned if psychokinetic phenomena were discovered to be true.

It seems that defining what Science is as a process may be harder to define than defining what it *is not*. It is certainly *not* just the limited body of facts and relationships (commonly known as physical "laws") in a contemporary textbook or set of textbooks. It is *not* pronouncements about the "impossibility" of this or that phenomenon or observation based on previously understood principles, measurements, or observations. Science does *not* properly allow statements of "belief" that any particular phenomenon, fact, or relationship is irrefutably established as being beyond the bounds of human scientific investigation. (Adherence to this characteristic of Science proscribes both dogmatic *religious* belief as well as dogmatic *scientific* belief, *i.e.* Scientism.)

Let me hazard a preliminary definition of Science, one I hope, is devoid of the taint of Scientism:

Science is the totality of human activity in measuring and observing the phenomena of existence and all that comes to human awareness, in a systematic effort—without known limits—to understand the quantifiable and non-quantifiable relationship of all phenomena to all other phenomena. The progress of Sci-

Editorial continued on page 70



LETTERS TO THE EDITOR

Parry Moon Issue a Godsend

Great work in the cover story of Issue No. 29 of *Infinite Energy Magazine*! As an amateur scientist and private researcher long in search of more basic truths than anyone dared teach me in college while being trained as an engineer, the article relating physicist Parry Moon's 1955 paper and associated editorializing was a godsend.

As Jeff Kooistra might know, I have been a fan of Tom Phipps and associate of the Graneaus. I have long worked directly with Charles Yost of the *Electric Spacecraft Journal* and written a number of articles for his journal. I am also a friend of Tom Ligon, who introduced me to Jeff. For about half of my fifty-three years, the odor coming off of accepted electrodynamics has bothered me. As an avid experimenter, the role of charge, and charge alone, has always seemed paramount and centered in my mind as the universal characteristic nascent in matter.

Bohren's work with light gave me inspiration, as he arrives at the conclusion that "the magnetic field is a convenient fiction" and that light is basically an oscillation of a charge dipole. I feel that magnetism is the physical manifestation of charges in motion or accelerating and nothing more. We call it magnetism.

Moving magnetic fields never create a charge! Charges in motion create a fiction called magnetic fields which are actually forces relating to and moving other extant charges, pondermotively, within matter. Moon's brilliant re-derivation of the old Weber equations, which were themselves extensions of Coulomb's work related to charge, is a stunning proof that magnetism started ruling physics when it was found it could be used to do big work easily and conveniently (1830s). I am stunned it was not called magneto-electric theory.

The classic and early charge separation electrostatics of Franklin, Coulomb, etc., was known to have forces associated with it. Unfortunately, they were weak for small surface areas and the low voltages allowable and handlable on earth and in air. Magnetic induction, in the 1830s and 1840s, showed that with just a few volts and a whole gang of current (read moving charge), enough magnetic force could be mustered to push a load of iron around, creating a lot of rotating inertia. From here it was "off to the races."

Technology and engineering drove science as electric machines based solely on the magnetic force drove the latter half of the industrial revolution. Magnetism was so very easy to create and the forces so large per unit volt that the old electrostatics became the stuff of parlor demonstrations. Copper masses rivaled iron masses in the race for ever more powerful electrical engines and devices. We became a current-spawned, magnetically driven world by 1900. It was fashionably dubbed electrodynamics but should have won the name magneto-dynamics. Maxwell was virtually forced to address magnetism as a separate entity in spite of the rather obvious fact that it was a second order effect at best and not "inherent in the system." Ultimately, dealing with magnetism as a separate and equal force threw a monkey wrench into the works. The process of this separation started before Maxwell, but saw its apex and ultimate enthronement with his great work.

I phoned Charles Yost with eager excitement once I read the article this evening. He noted that he had read it and was equally impressed and had passed it on to his science editor, Leslie Kulba. Oddly enough, she had phoned me earlier today to ask me what was new and newsworthy at my end here in Richmond. She and I talked at length about my ever more firm belief and thoughts on charge and its role in all things real. I noted that the electron was the sole particle influencing just about 100% of everything we see, do, and gain benefit from in our real world existence (electronics, machinery, chemistry, light's interaction with matter and our perception of it, etc.). Our conversation was interrupted by the mailman delivering my *Infinite Energy* and a plethora of worthless advertising. We were both in ignorance of the article (she had only just received it from Charles in her "in" basket), and yet discussing its principles.

I feel that the power for use in future deep space propulsion and space exploration will hail back to the old electrostatics and rely on charge in action, rather than magnetic forces. In space, billions of volts at a milliampere (megawatts) can travel on a tiny un-insulated wire to a 3 pound - 10 acre aluminized mylar film surface to create tremendous Coulombic forces. This can be used in rotating space system motors as well. Why drag tons of iron and copper into deep space to turn wheelwork?!

You folks have exposed some really

good work on a grand topic which needs full understanding and acceptance by the mainstream! I fear, as always, it will sink beneath the waves rather than be worked with to clear and illuminate a path out of the electro-magnetic inconsistencies so rife in the Maxwell work.

Keep up the good fight and avoid peer review at all costs! I found it refreshing and wonderful that you quickly discovered and reported the problems associated with the Boscoli work. At worst, for you folks, it was a waste of ink and valuable magazine space. There should be little embarrassment associated with a genuine spirited report, if when it goes sour, the fact is quickly reported. Those who might tend to question your future efforts based on this incident aren't looking at your honesty and forthrightness in correcting the mistake and are part of the herd you don't need to keep.

"Let the experiment be done!" (Franklin). . . Report your results honestly. . . And let those who would wisely consider using reason, logic, and common sense, be the judge. It appears that in modern peer-reviewed journals, it is no longer fashionable to do experiment and report novel, much less controversial results, leaving it there. They want a full theory or explanation using their safe concepts to explain fully any unusual results. No matter that you might not be up to the task of forming an entire theory or explaining your result to their satisfaction. They will not have it on the basis of that fact alone! Had it been published, better minds than the experimenter's reading it might have truly brought forth a wonderful cause or explanation furthering science. There are many triggers to the mind which only require the "cocking of the hammer." There is nothing wrong with one man cocking the hammer and another squeezing the trigger in search of the new and novel.

Richard Hull
Richmond, Virginia



On behalf of myself and fellow AIAS members I would like to request distribution of Dr. Parry Moon's paper (*IE* No. 29, pp. 10-17) to our membership for review, as we are all forging ahead a topological model for EM theory that goes much further than the Maxwell-Heaviside theory in use today. The new model explains the otherwise unexplainable, but observed and used, processes

of Nature. We hope to have a publication of this progress very shortly.

I would also like to extend my appreciation to *Infinite Energy* and its staff for courageously pushing the edge of science. It is on the edge or, more correctly, in the nonlinear regions that our classical theories tend to fail. However, Science is not dead as the popular press might have people believe, but in reality we have merely discovered the icing on the cake.

David B. Hamilton
U.S. DOE, EE-32
Washington, DC



"Physics is Sick"

I was sorry to learn that Nobelist Phil Anderson has voiced with regard to Randell Mills the same doctrinaire attitude that so many established physicists have adopted toward cold fusion (*IE* No. 29, pp. 40-41). Not that I aim to defend Mills, whose distinguishing merit seems to be what is sadly lacking in the makeup of most scientists—namely, the ability to attract \$25 million. The attitude I deplore is that of *total assurance*, which would be something permanently outside science if science had not in our day succumbed to political correctness.

Anderson objects to Mills' trying to "fuck with the hydrogen atom." In other words, if we must employ this Youthspeak, it is beyond the pale to "fuck with the Heisenberg postulate" . . . or that is the holy of holies, the immaculate Virgin that has been found to govern atomic physics and (without justification) has been supposed to govern nuclear physics as well. In fact, the earliest workers who scaled applications of the H. postulate downward from atomic dimensions by a factor of 100,000 were well aware of the "uncertainty" of the validity of what they were doing. But the next wave of physicists rapidly lost the prudent timidity of the pioneers. Although "success" *did not* reward the presumption of nuclear validity of the H. postulate, that postulate (which forbids the value of a certain matrix product expression to vary on any physical scale) was doggedly retained, for lack of a better idea, and band-aids such as threefold quarks were applied, to be followed by band-aids on the three-foldness, and so on.

The result is a Ptolemaic superposition of multiple band-aids—an accretion by now almost as deep as the guano on certain South American islands. It is known as the Standard Theory of particle physics; it possesses superb PR and media support and it is held together (thus far, I gather) by some twenty-eight adjustable parameters and

counting. This produces an outlook wherein nuclear physics is peripheral (the domain of second-class citizens), nuclear forces are "fringe" forces (analogous to molecular forces) of no fundamental significance, the long lifetime of the proton is a happenstance, etc. That of course—for them as likes it—is readily defensible as a "point of view." It is utterly despicable as the *only* point of view socially acceptable (or publishable) by those who label themselves physicists.

In my opinion we have had a great deal more than enough—an elegant over-sufficiency—of this Mutual Admiration physics. Physics is sick and the name of its malady is Consensus. What is needed is for disaffected groups to split off with deliberate intent to "fuck with the H. postulate"—or with any other unquestioned foundational tenet of the new Ptolemaism. Let's get some pluralism back into the presuppositions. Otherwise "physics" becomes contemptible—an Emperor's parade of backscratchers.

Thomas E. Phipps, Jr.
Urbana, Illinois



Resistance to New Discoveries

We are continually amazed at the resistance to new scientific discoveries. We were watching NOVA earlier this week, a segment about artificial hearts. One of the main researchers pointed out that every time scientists state that their goal is an artificial heart with a small mobile (internal) power source, and then display their latest pioneering effort, the imperfection of their effort causes the widespread opinion that artificial hearts shouldn't be tried or are physically impossible. He went on to say that without the first steps we can never reach the perfection we desire. It seems cold fusion is in a similar boat.

Rebecca Perkins and David Shorey
Edwardsville, Illinois



New Nuclear Model

I would like to tell you how my new nuclear model can help the performance of the cold fusion experiments.

According to my new nuclear model, the electric quadrupole moment has fundamental participation in the process of cold fusion. I think that it is because it is able to establish a resonance between the zero point energy of two nucleons H_2 .

Let us see how I understand the process. First of all, the two nucleons H_2 have an initial approximation. This is performed by the chemical reactions, and here we have the actuation of the activated carbon working together with the palladium. Of course, in this stage the electric quadrupole moment of ^{46}Pd is not important.

After the initial approximation due to the chemical reaction, the two nucleons H_2 start to have an approximation due to the actuation of the gravity. Here the process of resonance is fundamental. Therefore, the first thing that Dr. Les Case must verify is the composition of the palladium used as catalyst. It is necessary to discover what is the palladium isotope most suitable to get the cold fusion.

But I think that we can increase the velocity of the process if we introduce an additional source of resonance, in order to help the resonance due to the electric quadrupole moment of ^{46}Pd . This can be obtained as follows:

1) Suppose the oscillation of each nucleon H_2 due to the zero point energy has a frequency $f(Z)$. The conditions of pressure and temperature into the vessel can change the frequency $f(Z)$. The electric quadrupole moment of ^{46}Pd has a frequency of oscillation $f(Pd)$. Under a suitable combination of pressure and temperature, the electric quadrupole moment of ^{46}Pd can increase the amplitude of the oscillation of the two nucleons H_2 , when the frequency $f(Pd)$ is a multiple of $f(Z)$, that is, $f(Pd) = n \cdot f(Z)$, $n = 1, 2, 3, \dots$

2) First it is necessary to align all the nucleons H_2 along the same direction. We can obtain it by the application of a strong magnetic field into the vessel. Suppose that the two nucleons H_2 will be aligned along the z-axis direction. By this way the oscillation due to zero point energy will be along the z-axis direction.

3) We must apply an oscillatory electric field into the vessel, in order to submit the nucleons H_2 to an oscillatory motion along the z-axis direction. The oscillation of the electric field must have a frequency $f(E)$ multiple of the frequency $f(Z)$, in order to get the resonance: $f(E) = n \cdot f(Z)$, $n = 1, 2, 3, \dots$

I think that Dr. Les Case and Dr. Michael McKubre must try this experiment, changing the frequency $f(E)$ and keeping the pressure and temperature.

Wladimir Guglinski
Brazil



Kind Words from a Reader

Thank you for your extremely fast service in delivering my first copy of *Infinite Energy*. In this day of great technology I am forever amazed at the ridiculously unprofessional people in business on the Net who, after spending large sums of money on Web set-up, cannot even answer an email, even after enthusiastic response/interest in their products.

Yours is but the second of products

that I have ordered recently that have been delivered (almost un-natural in this mad world) efficiently and quickly.

Please keep up the good/hard work, and congratulations to all your staff for a wonderful magazine, dedicated to the brave and courageous souls who relentlessly pursue their research with vigor in the quest to provide mankind with pollution-free energy, against the greed of selfless politicians, bureaucrats, and narrow-minded conglomerations, who find clean/efficient fuel and energy threatening!

Dale McNeill
Australia

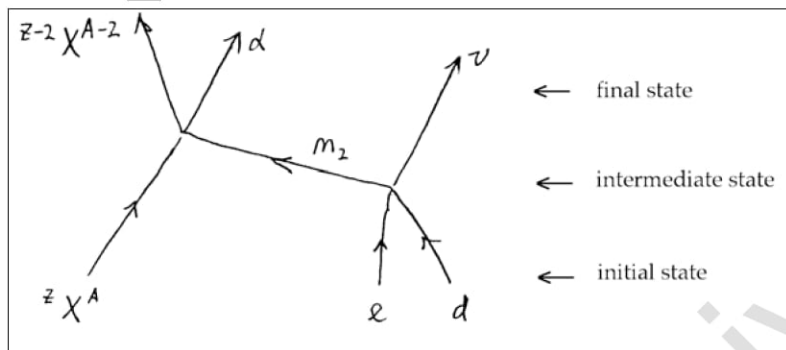


Deuterium in Ordinary Water Reactions

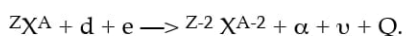
November 22, 1999

Dear George [Miley]:

Let me suggest a possible type of reaction that, in part, may explain the results of Miley and Patterson (*Infinite Energy* No. 9) and of Ohmori and Mizuno (*Infinite Energy* No. 27). The reaction relies on the fact that naturally occurring hydrogen contains 0.015% deuterium. Consider an initial state containing a deuteron-electron pair and a nucleus ${}^Z\text{X}^A$, atomic number Z and mass number A. The deuteron captures the electron and forms a neutron-pair while emitting a neutrino. This is the non-energy-conserving intermediate state. The final energy-conserving state occurs when the nucleus captures the neutron pair, emits an alpha particle, and transforms to a nucleus ${}^{Z-2}\text{X}^{A-2}$. The mass of the virtual neutron-pair exceeds that of the deuteron-electron pair by an amount equal



to the neutron hydrogen-atom mass difference, 0.78 MeV. The energy of the intermediate state is greater than that of the initial and final states. This results in an effective attractive interaction between the nucleus and the deuteron-electron pair. The total reaction is:



There are many exothermic examples of this reaction. Here are several:

${}^Z\text{X}^A$	${}^{Z-2}\text{X}^{A-2}$	Q
${}^7\text{N}^{14}$	${}^5\text{Be}^{12}$	0.16 MeV
${}^{12}\text{Mg}^{24}$	${}^{10}\text{Ne}^{22}$	4.71
${}^{14}\text{Si}^{28}$	${}^{12}\text{Mg}^{26}$	5.35
${}^{16}\text{S}^{32}$	${}^{14}\text{Si}^{30}$	9.04
${}^{16}\text{S}^{34}$	${}^{14}\text{Si}^{32}$	8.08
${}^{18}\text{Ar}^{36}$	${}^{16}\text{S}^{34}$	10.33
${}^{18}\text{Ar}^{38}$	${}^{16}\text{S}^{36}$	6.55
${}^{18}\text{Ar}^{40}$	${}^{16}\text{S}^{38}$	2.77
${}^{19}\text{K}^{39}$	${}^{17}\text{Cl}^{37}$	25.81
${}^{22}\text{Ti}^{46}$	${}^{20}\text{Ca}^{44}$	7.95
${}^{28}\text{Ni}^{58}$	${}^{26}\text{Fe}^{56}$	10.99

Of course, the energetic alpha particle from this reaction may in turn generate secondary nuclear reactions. One way to test the viability of this reaction is to see what happens when the reaction vessel is deliberately seeded with additional deuterium.

Robert Parmenter
Emeritus Professor of Physics
University of Arizona
Tucson, Arizona



Muons the Key to Cold Fusion?

Remember cold fusion? Much has been written about it, but perhaps this approach has been missed.

Fission is a chain reaction fed by neutrons. Fission produces neutrons and neutrons produce fission. Fusion requires continued high pressures to be self-sustaining. Fusion may produce neutrons, but neutrons do not produce fusion.

Letters continued on page 69

Errata

Reference 11 in Kanarev's "The Source of Excess Energy from Water" (Issue No. 25, p. 58) was incorrect. The article referred to was published in *Infinite Energy* No. 20, not No. 22.

Infinite Energy Solicits Your Manuscripts Dealing with:

- * Experimental Results in Cold Fusion and New Energy
- * Theoretical Ideas
- * Book Reviews
- * Contemporary and Historical Opinions
- * Historical Articles
- * Short Articles on Conventional Energy or Alternative Energy

Contact Barbara DelloRusso, Managing Editor, to receive Instructions to Authors for our preferred format.
staff@infinite-energy.com or 603-228-4516

"Websites Worth Your While"

<http://www.intranet.csupomona.edu/~physics/demo/elect-mag.html>

A clear, concise, yet highly informative list, with illustrations, of the electricity and magnetism demonstrations they use at Cal Poly University.

<http://www.stardrive.org>

Interesting and informative site with lots of far out physics, fascinating links, and intriguing graphics.

<http://www.xs4all.nl/~westy31/Electric.html>

Electric circuit diagram equivalent of fields. A developing site wherein electronic circuit analogs of physical phenomena (like heat conduction and acoustics) are shown.

<http://www.songs.com/cgi-bin/discussion.pl/philomsgbd:www.songs.com/>

The Philo T. Farnsworth Fusion Discussion Board. This is where the guys who've been working on fusors hang out, swap stories, and ask each other for advice. Serious experimenters are welcome.

Special Bonus Site

http://www.nelsonplain.com/a_corbdome.jpg

This is the world's coolest lunchbox ever!

—JDK

Infinite Energy does not endorse these sites or products.

Farnsworth Meets Tesla



"Knowledge is power."

Sir Isaac Newton

One of the first friends I made in the science fiction field was Tom Ligon, the author of this month's cover story. Tom and I were both becoming fixtures at *Analog Science Fiction and Fact*, and via e-mail and online forums, we found that we shared a wide range of interests. He and I had already been exchanging long e-mails about physics when Dr. Phipps sent me my first paper on the Marinov motor. I sent a copy to Ligon, and it was he who first hit upon the idea of fixing the ring and letting the magnets turn. On that score, the rest is history.

Ligon was also one of the first people to take up Dr. Peter Graneau's challenge and attempt to figure out why ferrous armatures roll backwards on railguns (see "Don't Burn Those Books!" *IE* No. 27, p. 9). I could tell early on that here was a guy who preferred *doing* to just talking about doing.

Ligon's "day job" involved working on a fusion machine that owed its parentage to the Farnsworth Fusor (fusion reactor), and he decided it would be a pretty neat idea to write an article about a version of the thing suitable for a capable high school student to construct, and we've reprinted a version of that article.

This was the kind of guy I had to meet!

As it turned out, Ligon had made the acquaintance of one Richard Hull of Richmond, Virginia, who happens to be one of the foremost experts in the country on Tesla coils and high voltage gee-wizardry—the kind of Teslaniac

every new coil builder aspires to be. And as it also turned out, Richard Hull had been doing water arc experiments for Dr. Peter Graneau (see, for instance, *Newtonian Electrodynamics*, by Peter and Neal Graneau, World Scientific, 1996, especially chapters 6 and 7), and I wanted photos of the test rig for an article I was planning to write.

An opportunity to kill this many birds with one stone comes along rarely, so I made plans for a trip to Virginia.

Unfortunately, Ligon's original fusor had met with an untimely fate, which he describes in his article, although the remains were still in fairly good shape. But Richard Hull had begun building his own fusors, so I was going to be able to see a working device at his place anyway.

One thing you've got to understand about Richard Hull is that he doesn't do anything half way. I once found a reference to him on the Web where a guy at some Tesla website described him more or less this way: "Richard Hull has already done every Tesla project you've been thinking of doing, and done it better than you can do it." So here's Hull, having done all the Tesla stuff, and suddenly this Ligon fella introduces him to a fusion device you can build at home. He didn't waste any time in getting busy.

It was a two hour drive from Ligon's house down to Richmond, but the time passed quickly—science fiction authors know how to make interesting conversation. Somewhere in Richard Hull's laboratory there's a house where he lives with his wife. He has a garage that's entirely surrounded by a Faraday cage, and contained therein is the highest concentration of high voltage technology I'm ever likely to see in my life. He showed Ligon and me some fascinating demonstrations and I learned more about how to construct a decent Tesla coil in five minutes from him than I did from any of the books I'd read on the subject.

Upstairs was where Hull had his first incarnation of the fusor. He fired it up for us and in short order I got to see the eerie glow of ions recirculating through the inner grid. One of the nicest things about

fusors is that they're pretty cool to play with even if you don't want to try to do fusion at home. Just using ordinary rarefied air in the chamber will give you plenty of "light show" to manipulate and experiment with. However, Hull is not the kind of guy to remain content with just that. As you can see from some of the pictures he sent us, he's taken his home experimenting to a rather professional level.

While I was there, I did photograph the cannon used for the water arc experiments, but we didn't set it up to fire. But I've saved for the end of this column the account of the neatest thing I saw there. If any of you readers watch the Discovery Channel, you, too, might have seen the thing I'm about to describe, particularly if you watch shows on lightning.

In his garage, Richard Hull has a version of a Tesla coil, which Tesla called his magnifying coil (see p. 378 in *The Complete Patents of Nikola Tesla*, Jim Glenn, ed., Barnes and Noble Books, 1994). This is a Tesla coil with a third coil which gets pumped up to very high voltages. To the uninitiated, this looks just like a big, silver donut hanging from the ceiling with some electrical connections to other equipment mounted on the wall. Before running the coil, we had to clear the area out from underneath it. Then Richard supplied us with ear protection and we turned out the lights and fired up the transformers that power the beast.

Quite a howl is let out as the magnifying coil builds up, but it doesn't take long before lightning starts to fly from the donut. Sparks five feet, eight feet, ten feet long come off. They seem to snake out. I felt like I was in a Cecil B. DeMille biblical epic as I witnessed it, and in my bones I felt the truth of Newton's dictum "Knowledge is Power." For it is through knowledge that Richard Hull is able to throw thunderbolts and Tom Ligon is able to fuse nuclei.

And with my own Warlock's Wheel work, it seems likely that Newton's dictum will outlive his laws.



The World's Simplest Fusion Reactor, and How to Make It Work

Tom Ligon*

This article originally appeared in the December 1998 edition of *Analog Science Fiction and Fact*. Although edited slightly for *Infinite Energy*, it was intended for a fairly broad audience, especially high school science students. —Tom Ligon



Tom Ligon.

Photo Courtesy Tom Ligon

A really distressing trend has been developing for some time among scientifically knowledgeable people I have met. A lot of you are growing quite pessimistic about the prospects for practical fusion power in general, and fusion-powered space travel in particular. The roots of this disillusionment are not hard to find.

Fusion, for those of you who slept through high school physics, is the process of squashing two atomic nuclei together to produce a new element. Many light-weight nuclei give off copious energy when this happens. In the Sun, hydrogen nuclei fuse (we pretend we know the mechanisms) to form helium. A tiny fraction of the original mass is converted to energy according to $E = mc^2$. The process occurs deep in the Sun's core, at mind-boggling temperatures that cause the nuclei to move rapidly, where similarly mind-boggling pressure keeps the nuclei in close proximity, and sheer bulk prevents rapid heat

escape. The physics community often calls these "thermonuclear reactions" because of the high temperatures driving them in the Sun or triggering them in "hydrogen" bombs. *Infinite Energy* readers may have some differing opinions as to the exact mechanism, but in any event the Sun's process involves some temperature and density conditions difficult to sustain on Earth. The Sun is a *gravitational spherical confinement device*, something not even the contributors to *Infinite Energy* seem to have in their laboratories.

When I was studying Health Physics in the mid-1970s, the nation was well into a program to develop "practical, clean thermonuclear fusion power." This was universally acknowledged to be a considerable technical challenge, but we were told to expect results in, say, twenty-five to thirty years. Well, twenty-five years have come and gone, along with twelve+ billion fusion research dollars (over the past forty-five+ years), and those researchers have announced that they have made a great deal of progress. They say if we will only fork over the money (another ten to twelve billion) for the next stage of R&D, they think they might be able to build a net power demonstration reactor in another twenty years. This should lead to a workable fusion power plant in about forty or fifty years, for *another* \$25 billion. Present indications are that the resulting power plant would not be able to run competitively with any current power plant technology. The power industry doesn't see much value in reactors which cost billions each and have a life expectancy of only a couple of years.

The focus of most of the present Department of Energy (DOE) research is large tokamaks. How large? The ITER machine was planned, with the supporting equipment and structure, to be about the volume and mass of an aircraft carrier. If it is ever built, it will use gigantic toroidal superconducting magnets, storing magnetic energy equivalent to one-fortieth of a Hiroshima bomb, which would be released suddenly if the liquid helium cooling system were ever breached and any one of the magnets warmed above the critical superconducting temperature. Surrounding the machine is a blanket of molten lithium one to two meters thick, not nice stuff to spread about the countryside if the magnets blow. The core of the machine is a torus (donut) sixteen meters high and twenty-two meters across with a cross section diameter of five meters, whose structural material will become radioactive as the machine runs. This beast might actually hit break-even occasionally (*i.e.* produce as much power as it consumes), with a little luck. Presuming working power plants would be even larger and heavier, the system does *not* look promising for strapping on the back of a rocket!

Additional work continues on laser-fired and particle beam-fired fusion. The reaction vessels proposed for this program are considerably smaller, however the lasers or beam guns and power systems to run them are even larger and more massive than those of the tokamaks, making them prohibitive for space propulsion use too.

Both systems struggle to overcome the three competing factors which have so far made thermonuclear fusion such a formidable challenge. The goal is to slam fuel nuclei together hard enough to make them stick and form new elements. Nuclei carry a positive

charge, and like charges repel, and they do so more vigorously the closer they approach. This "Coulomb barrier" is the force which must be overcome to cause "hot" fusion. ("Cold fusion" approaches, *i.e.* proton or deuteron interactions with heavier nuclei in solid state, occur in a sea of electrons, which drastically reduce the range of the Coulomb barrier.) To make a useful hot fusion power reactor, you must have particle velocity, density, and confinement time sufficient to produce enough reactions to generate more power than is required to drive the reaction.

The formula for fusion rate per unit volume is

$$n_1 n_2 \sigma_F v$$

where

- n_1 and n_2 are the densities of the two colliding fuel species (n^2 is substituted if only one species is present, as in DD)
- σ_F is the fusion cross section at the velocity or particle energy
- v is the particle velocity.

This equation, with different cross sections, is used in chemical kinetics as well as other nuclear applications and would also work for calculating hits of anti-aircraft shells on a swarm of aircraft. You will kindly notice that *nowhere in the above equation will you see temperature, T!* You can calculate a spread of velocity (v) in a population of particles from temperature, but velocity is the actual parameter required. The value v is generally frame-shifted to assume one particle is moving and the other stationary, since the cross sections were measured in that manner in linear accelerators. The value σ_F is a function of v and is generally tiny for low values of v . It starts becoming useful at velocities corresponding to temperatures of a hundred million Kelvins or more and peaks out at some much higher velocity. Cross sections are in units of area. Achieving useful fusion requires some balance of high density and velocity, and if the resulting fusion rate is low, high confinement time with no additional expenditure of energy can potentially make up for it.

Tokamaks use magnetic confinement and inject energy into the confined plasma (typically by huge current discharges or bursts of microwave energy) to heat the plasma to temperatures which raise the velocity of the nuclei to overcome the Coulomb barrier. The powerful magnets surrounding the reactor force the plasma ions (ions are atoms missing some or all of their electrons) to follow tight circular paths within the machine, isolating the plasma from the walls and giving high confinement time, thus opportunity to react. However, there are practical limits to magnetic field strength, and those limits are felt most severely under just the conditions where trapping is most needed. The fast-moving ions needed to cause fusion make larger orbits than slower, cooler ions, and thus temperature and density are in constant conflict. There is also an inherent stability problem in these machines: when ions collide *without* causing fusion (which is most collisions in a thermal system), they tend to "jump to new field lines." Just a few collisions will likely make them jump to the wall of the machine. The net result is that while large tokamaks using superconducting magnets placed outside the torus and lithium blanket can confine hot ions for long times at low density, or cold ions for long times at higher density, you must build very large machines in order to achieve sufficiently high temperature (high ion velocity) and high density at the same time. Small copper-coiled machines with the coils *inside* the lithium blanket, such as R.W. Bussard's "Rigatron," can achieve the required field strength at much lower cost, but would have an operating life of around thirty days due to neutron damage to the magnets.

Laser-fired and particle beam-fired approaches (called Inertial Confinement Fusion, or ICF) use small pellets or capsules of

fusion fuel flash-heated by extremely powerful lasers or particle beam pulses. The fuel is usually liquid or even solid, so initial density is already high. The capsule is not just a fuel container. It serves to absorb the laser or beam energy, compress the fuel as the capsule explodes, and provide mass (and inertia) to confine the fuel. The challenges in ICF stem from the fact that high temperature causes rapid expansion of the capsule and fuel: temperature and confinement time are in conflict. ICF machines also have their own instability problem: once you compress the fuel pellet to a small fraction of its normal size, it will find any little gap in what you are compressing it with, and try to squirt out. So far these problems have frustrated attempts to produce useful ICF fusion.

Both of these methods have achieved some limited success. That is, they have produced some fusion, and one tokamak has even reported "break-even" (in a research sense, but far from that needed to totally power itself). However, both use heat as the means of raising the velocity of the ions, what physicists call "Maxwellian" (randomly oriented and distributed) velocity. Stephen L. Gillette would use the term "Promethean,"¹ for Prometheus, the bringer of fire. Both approaches rely on the principle that a heated plasma contains a wide distribution of particle velocities. "Temperature," in the sense of gas and plasma physics, is the average kinetic energy of the particles involved, and kinetic energy is proportional to particle mass and the square of the velocity.

The trouble is, neither approach brings the *average* ion kinetic energy up high enough to cause fusion. Only the fastest few percent of ions reach the energy needed to overcome the mutual repulsion of the Coulomb barrier. Furthermore, the heated ions move randomly in all directions, thus collisions are at random angles which usually do not produce fusion. What they need is particles hitting head-on at fusion velocities, but what goes on in thermal systems, at the particle level, is virtually uncontrolled chaos: fast and slow particles colliding like bumper cars at all angles.

Finally, while these heat-based methods *do* produce *some* fusion, they do so *only* with the easiest of fuels: deuterium ("heavy hydrogen," with a nucleus of one proton and one neutron), tritium (one proton with two neutrons), and helium-3 (two protons and one neutron). Thermonuclear fusion has been pushed on the public as "clean," *i.e.* not producing nuclear waste. This turns out not to be the case. Reactions between two deuterium nuclei (DD), or deuterium and tritium (DT), produce neutrons. Most of the useable energy in the favored DT systems comes from the neutrons, and the only way to exploit it is to slow them down in a blanket of absorbing fluid (usually liquid lithium) which is then used to make steam to run a turbine (more Promethean technology). In fact, the DT systems *depend* on neutrons reacting with the lithium to produce more tritium fuel, for tritium is a fast-decaying radioactive isotope not found in nature. The neutron-lithium reaction also breeds helium-3.

From time to time you may hear about this miraculous nuclear fuel, helium-3, which supposedly can be mined from the lunar surface (actually, the Jovian atmosphere is probably a *far* better source). The claim often heard is that the reaction between deuterium and helium-3 produces no neutrons. While this is true, any such reactor will also produce deuterium-deuterium reactions, which *will* produce neutrons. While it is a substantial improvement over tritium, it is far from aneutronic. If a DT reactor could kill you in one second, a DHe³ reactor would require about *thirty* seconds to kill you. Besides, as mentioned above, that lithium blanket has a purpose: it reacts with the neutrons to produce tritium and helium-3! The aneutronic reaction can't breed its own fuel, but the neutron producers can.

While the neutrons produced by these reactions can be har-

nessed to make heat and more fuel, they have very undesirable side effects. They render many engineering materials radioactive, transmute their elements, and produce metallurgical damage. Thus, after a few years of operation, the inside of the reactor becomes weakened and possibly even deformed. Repairs and disposal of the damaged material are greatly complicated because it is radioactive.

Fusion the Easy Way—Using Vacuum Tube Technology

There are a variety of other potential fusion fuels for which the necessary temperatures for fusion are simply too high to be achieved by the *thermonuclear* technologies the DOE is currently pursuing. How do we know about these reactions? We have been doing them since 1928, using extremely simple devices called linear accelerators.² Charged particles can be made to accelerate to enormous velocities and energies by means of simple electric fields. By charging a grid to a few hundred thousand volts, you can accelerate protons or other light nuclei fast enough to fuse with almost any element in the periodic table. True, it takes far more energy to run such a device than it produces, but the equipment is extremely simple, and the “temperatures” achieved are easily sufficient to produce most transmutation reactions between nuclei.

Let’s bury this “temperature” nonsense right here and now. While you may have heard a figure of something like fifty or a hundred million degrees being required to produce fusion, in fact few researchers use those numbers except to impress the public. The units of temperature they use are “electron volts,” which are easily understood in terms of linear accelerator operation. For every electron’s worth of charge on a particle, multiply by the volts on the accelerating grid to get electron-volts of energy. For purposes of impressing your friends, for each electron volt, multiply by 11,604 to get degrees Kelvin. You may be amused to know the electrons hitting the screen of the typical television set are around 200 million degrees Kelvin according to this scheme, and 50 million degrees Kelvin is a paltry 4300 electron volts.

At about the same time linear accelerators were first being developed, development of vacuum tubes, or electron valves,

was being refined. Vacuum tubes use the principle that a very hot metal surface will emit a cloud of electrons, which can be caused to cross a gap in a vacuum to a positively charged “anode.” In simple diode vacuum tubes, a hot tungsten filament or heated thin cylindrical surface (the “cathode”) is surrounded by a cylindrical anode (also called the “plate”) and electrons will flow from the cathode to the anode, but not from the anode to the cathode.

One of the best-known researchers in the field was Irving Langmuir, who developed theories and confirmed by experiments the principles of “space charge limitation” between tube elements composed of concentric cylinders. In 1924, Langmuir and Katharine Blodgett³ investigated the case of concentric spheres as a vacuum tube configuration. While the device worked well, the normal configuration was concentric cylinders, which were much easier to manufacture and also worked well, so there was no widespread use made of this development at the time. Limited use of the spherical configuration includes some “multipactor” tubes and certain specialized light sources.

In the mid-1950s, P.T. Farnsworth (one of the inventors of television) pondered the bright visible convergent focus glow that forms in the center of spherical multipactor tubes and came up with the idea of using a spherical diode as a fusion machine. Called the “Fusor,” the device, later patented,⁴ would cause ions of fusion fuel to speed to the center of the machine. As they converged on the central focus region, their density would increase rapidly, making collisions more likely.

Farnsworth’s original machines used a spherical array of ion guns and were treated as though the ions got only one pass through the center. Later machines, especially “Hirsch/Farnsworth” machines, used very open spherical wire grids to accelerate the ions, and achieved considerable ion recirculation. Ions which did not collide would decelerate out the other side, stop, and accelerate back to the center for another try, conserving energy. The class of machines based on this principle are “spherical convergent focus electrostatic ion accelerators,” with the abbreviation IXL to remind us that they use the grids to accelerate *ions* (see Figure 1). Because they use simple electrostatic forces to accelerate and confine ions and rely on the inertia of the

ions to store energy for collisions, the term Inertial Electrostatic Confinement (IEC) is used for machines of this type. Be careful not to confuse it with ICF, or laser/particle beam fusion.

By 1959, Elmore, Tuck, and Watson⁵ explored the idea of using Farnsworth’s gizmo backwards to accelerate *electrons* from the outer sphere (a cathode) to the inner sphere (an anode). The inner sphere of such a machine is a grid. This forms a geodesic “potential surface” which the electrons aim for as if it were solid. However, when they get there, most pass right through and coast in a straight line, converging from all sides to the center, then they pass out the other side. What results is a region at the center of the inner sphere with a very high density of negative charge, called a “virtual cathode.” This region will attract positively-charged ions, which will tend to oscillate back and forth through the central region. Provided more electrons are force-fed into the system than ions, a “potential well” is formed in which the ions are trapped by

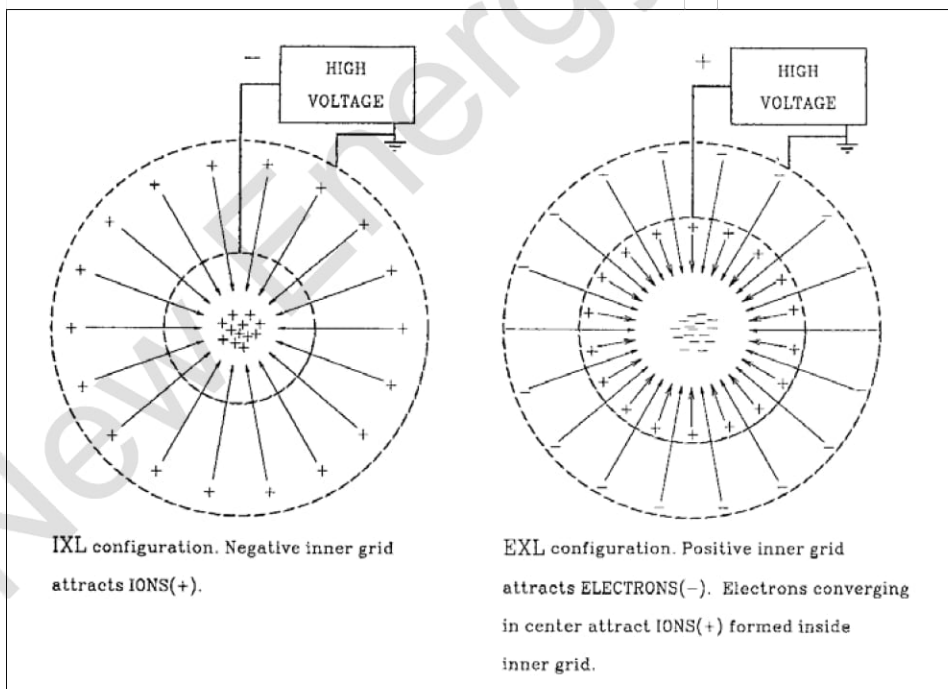


Figure 1. The two basic spherical convergent focus fusion methods.

excess negative charge. Interestingly, an ion oscillating entirely inside the inner grid will be trapped almost indefinitely and will conserve its initial kinetic energy remarkably well, thus theory predicted this device might be a surprisingly efficient ion trap. However, the electrons had to pass through the grid, which meant eventually most of them would *hit* the grid. Depending on the grid's "transparency," an electron might make ten to fifty passes before being lost, requiring another electron and the power to fire it into the system. Because the electrons had to outnumber the ions by a significant margin, the researchers expected this device could be harnessed to produce only tiny amounts of fusion, and decided it could never make a workable power reactor. The Elmore-Tuck-Watson concept is an electron accelerator, or EXL machine (see Figure 1).

In 1967, Dr. Robert L. Hirsch published a paper describing a concentric sphere device which produced "copious neutron emission."⁶ Hirsch (working at the IIT/Farnsworth Lab under Farnsworth's enthusiastic encouragement) primarily worked with the IXL configuration, with the cathode (negative grid) in the center and the anode (positive) to the outside. His machine was a spherical version of a linear accelerator: positive ions formed at the anode accelerated toward the central cathode grid (*i.e.* IXL and EXL machines are similar but of opposite polarity). Again, the accelerated particles usually miss the inner grid, continuing on to the center of the device. There they stood a fair chance of collision, and very importantly, all of the particles were *at the same energy*, which was sufficiently high for fusion to occur. If they missed or collided without producing fusion, they could travel out the other side, conserving their energy for another pass through the middle. Although not all collisions were head-on, particles which did not fuse rebounded with most of their original energy. It did not matter in which direction they rebounded as all directions were "uphill" against the potential gradient, so they slowed down and came rushing back "downhill" for another try. Like the Elmore-Tuck-Watson design, the losses due to grid collisions prevented break-even; nonetheless, a lot of fusion was possible.

Dr. Hirsch operated his machine at up to -150,000 volts on the inner grid, at currents up to 60 ma. Using DD and DT, the machine produced abundant fusion but far below break-even. The neutron emissions he achieved (published results on the order of a billion neutrons per second, and unpublished results of around a *trillion* per second!) would be considered dangerous today. Hirsch also built an Elmore-Tuck-Watson EXL machine, and verified it would produce a deep potential well.

What Hirsch's machine demonstrated was that, contrary to

popular belief, fusion is actually quite easy to produce, once the *thermo* mindset is shed. The problem is to come up with a configuration that does not waste the drive energy.

The Nuclear Reactor High School Science Project

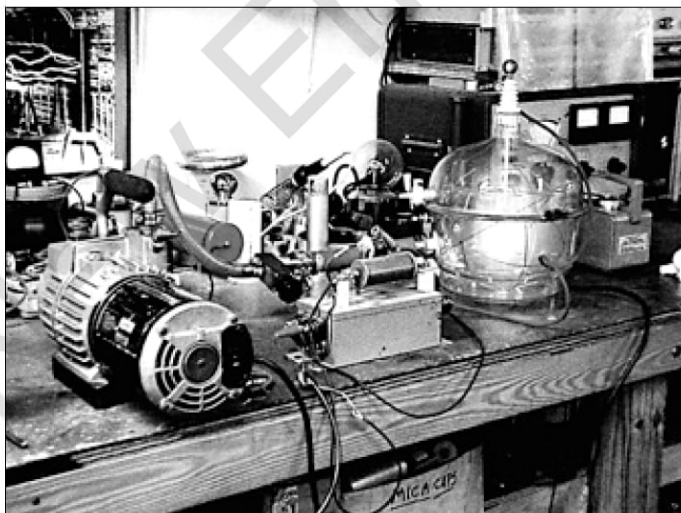
I notice a few of you have gone glassy-eyed on me. Trust me, this is *easy*. A Hirsch/Farnsworth machine is so simple it could be built as a high school science project (though I caution anyone without the necessary skills to seek knowledgeable advisors, and good safety practices *must* be followed). You will need to borrow, buy, or build some vacuum equipment, obtain a small supply of deuterium, and figure out some instruments so you can tell if it is working, but the actual reactor components are *trivially* simple to build and will cost only a few cents!

WARNING

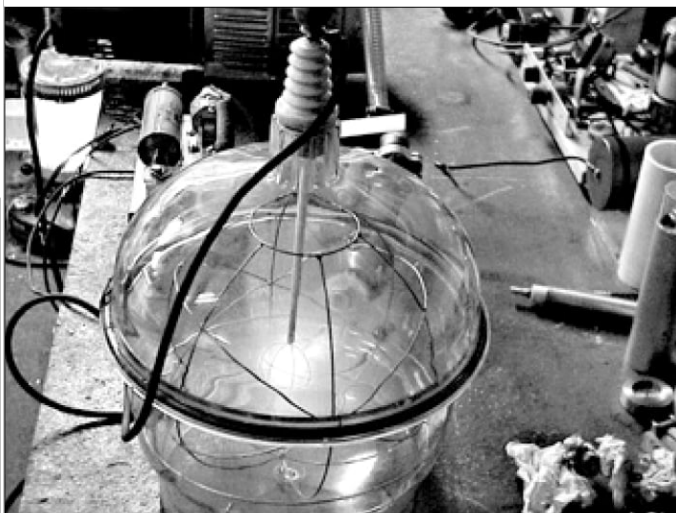
The apparatus described in this article uses high voltages at potentially lethal currents. High vacuum apparatus and compressed gasses may also be dangerous if improperly used. This device may produce ultraviolet radiation and soft X-rays. Do not attempt to build or operate such a device unless you have been trained in high voltage safety and safe use of compressed gas cylinders and vacuum equipment, and can verify that no unsafe radiation exposure occurs.

Regarding the presumed danger of building a nuclear reactor, the simple fact is that the proposed machine would run at the very bottom end of the voltage required for fusion, and it will take some skill and effort to even detect the neutron output. The *real* danger is in the potentially lethal high voltages used, and some lesser concerns for safe handling of compressed flammable gas and operation of vacuum equipment. A metal vacuum vessel will stop virtually all of the weak X-rays which may be produced (a little tamer than those produced by a television), and a thick glass window will stop most ultraviolet radiation produced. The voltages involved are somewhat lower than those present in an ordinary television set, which also has a large, fragile, glass vacuum vessel, and I would characterize the project as about as dangerous as television repair. They still teach television repair in high school technical education programs, don't they? But make no mistake, the insides of a television set can kill you in a heartbeat.

While you will wish to rig a method for detecting and quan-



A fusor you can build.



The glow within the grids of a simple fusor.

Photos Courtesy/ Richard Hull

tifying neutron production (that being the proof you are making fusion), the levels produced by the machine described below should be so low you would have to stand a meter away from the machine for twelve days of continuous operation before you got a 100 mrem dose of neutrons (and that is a *small* dose). Most likely, the device will be run only for a few minutes at a time at actual fusion conditions. Still, if for no other reasons than the educational benefits and common sense, I would advise the experiment be done with due consideration to nuclear safety. For those who don't wish to "go nuclear," or who cannot find qualified advisors, you can still demonstrate the visible glow by using a non-nuclear gas (the residual air in the vacuum chamber will do) running at below fusion voltages. In fact, even without producing fusion, you can do a lot of interesting and useful science with these devices. (*Infinite Energy* readers may be fascinated to know that a pesky effect which occurs during cleanup of a new grid fits the definition of "pulsed anomalous glow discharge.") (Editor's Note: See *IE* No. 7 and 8).

The expensive component is the vacuum system, which may need to be borrowed or scrounged. The pressure required can be achieved by a simple, mechanical rotary-vane roughing pump (a two-stage "micron" pump used for refrigeration repair will do), if the system is compact and tight, although it would be preferable to have a higher-performance system. Such a pump, used, can cost around \$750 (a lucky scrounger I know has stumbled onto several for \$150 or less), so a borrowed pump will be a real advantage if you are as broke as I chronically was in high school. A vacuum chamber and some high-voltage and conventional electrical feedthroughs will be needed. A metal vacuum chamber with a thick glass view port is far preferable. I have built a small demonstrator device in a \$90 plastic desiccator chamber, but it did not achieve good enough conditions for fusion and finally failed due to a stray electron beam heating the walls. It provided little protection against X-rays or ultraviolet light. Glass vacuum containers such as bell jars are fragile, and consequently dangerous, and must be used with guards, face protection, and great care. Spark plugs will do as high voltage

feedthroughs, and spark plug wire for high voltage cable for researchers who are "cash challenged." Homemade vacuum instruments can be made from light bulbs or old vacuum tubes.⁷

I have achieved the blue glow of convergent ion focus using a furnace ignition transformer and a pair of high-voltage diodes. This will produce close to 5000 volts, and ignition transformers are usually current-limited to a level that *probably* won't stop a healthy teenage heart. Such a transformer will not produce significant fusion, but makes a pretty glow, demonstrating the convergence effect.

Higher voltage and power can be obtained using a 15,000 volt (7500 volt RMS center-tapped) neon sign transformer with two high voltage diodes, which can produce over 10,000 peak volts DC and considerably more current than the ignition transformers. I have successfully pushed such a transformer to 13,000 volts. This power source *can* produce measurable fusion. Before buying one, check with an electrical contractor who remodels commercial property, as they frequently dispose of such transformers from old neon signs. You want at least the higher-current 60 mA variety if you can get it, or several 30 mA transformers in parallel, or, better yet, three 60 mA transformers on a 3-phase power source. *This type of transformer can kill, particularly if you use a capacitor on it to filter the AC ripple.*

Deuterium gas is not radioactive and can be purchased without special license through many gas suppliers, sometimes even through welding suppliers. A lecture bottle should cost under \$300. You will also need a suitable regulator, which you may be able to borrow or at least re-sell after you are done with it.

The reactor grids themselves will cost a few cents and take about an hour to build, if you have access to a small spot welder. What, no spot welder?! Build one yourself with common parts from an electronics store.⁷ Each grid can be formed from six rings of stainless steel welding wire. I have used 0.025 inch diameter wire, which is cheap and easy to work. Buy it from any welding supply dealer. Figure 2 shows how to fit the rings into geodesic spheres. The dimensions can be adjusted to fit your apparatus. Typically the outer grid is somewhere between the size of a basketball down to the size of a volleyball, and the inner grid is about the size of a ping-pong ball. You may gather from this that precision in diameter is not an issue. Also, it is surprisingly unimportant that the grids be perfectly spherical or mathematically precise, although the best machines are built with precision.

I've deleted my original description of poor-boy neutron detectors, as the *Infinite Energy* crowd is rife with "cold fusion" researchers, experts at hunting tiny neutron fluxes. I will mention that proton-recoil scintillation counters are one of the best options, among the many in the literature. BiCron 720 is specifically intended for fast neutron detection, and is ideal for DD and DT fusion neutrons.

A professional lab could probably manage to sink \$50,000 in equipment for such

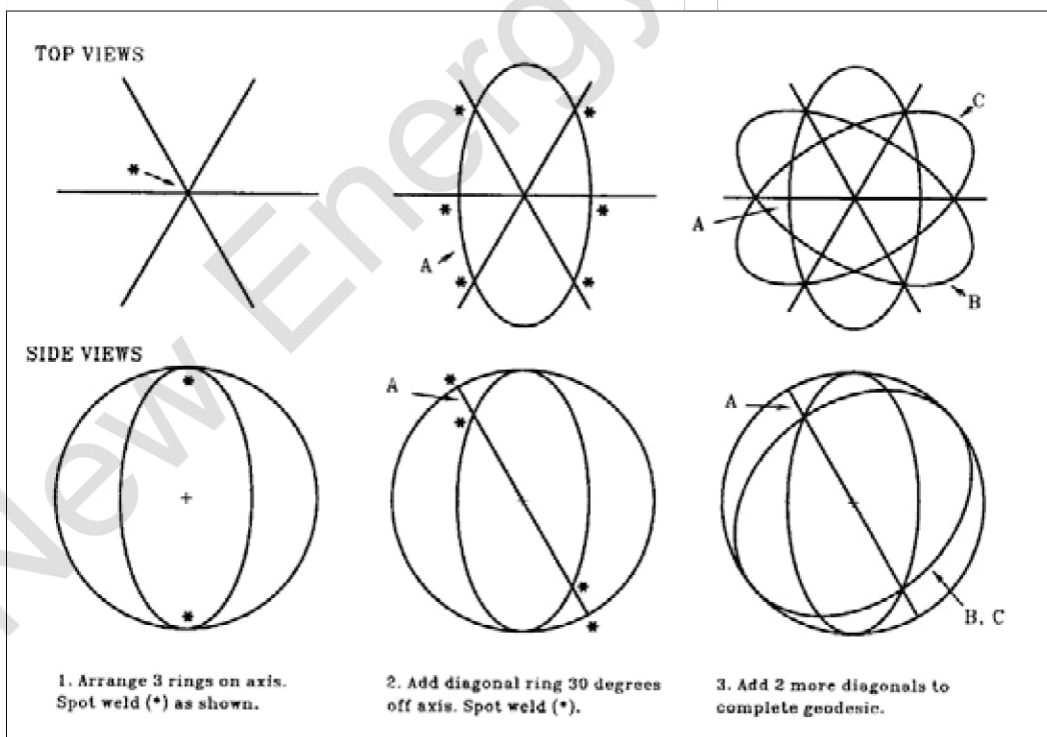


Figure 2. Geodesic grid constructed from six wire rings.

a project. My own personal machine, built of about 50% used equipment, cost about \$3000. I suspect a particularly talented scrounge/beggar could get by for around \$500 out of pocket, which I estimate could be raised in under a month of flipping burgers, or a couple of days of computer consulting.

At higher pressures (about 1/100,000 of atmospheric pressure), the system will work in "glow discharge mode," the way a neon sign works. This is the easy way to go, as it requires no fancy electron guns, ion guns, or extra power supplies. Those of you with access to higher performance vacuum systems may wish to venture to lower pressures, where the ion recirculation becomes far more efficient. There are a number of ways to do this, but they are too involved for this article. These methods are described in the referenced papers and can also be accomplished with cheap and available odds and ends.

If you jack the inner grid voltage on this simple little machine up to 10,000 volts or more, and feed deuterium to the system at a pressure a little under 10 microns (1×10^{-2} torr), it should produce fusion, evidenced by neutrons. I have seen a seventeen-year-old build a grid that produced 300,000 neutrons/second at 13,000 volts.

So you see, you *can* build a fusion reactor with parts from an electronics store, auto parts store, welding shop, refrigeration supplier, hardware store, and craft store, perhaps with a bit of dumpster-diving on the side, and creative use of big, sad, pleading eyes. It really *doesn't* take tens of billions of dollars!

These hints should be enough to get you started. I don't want to describe the apparatus *too* completely, because hitting the books and figuring this out is how you earn that science fair prize dancing before your eyes right now. There are a number of people on the internet who are doing this very thing right now (a search for "Farnsworth fusor" is a great start). Chief among them is Tesla-coil guru Richard Hull, who was literally enthralled by a machine I showed him a few years ago.

Can The Problems Be Overcome?

While machines based on Farnsworth's Fusor are indeed easy to build and worked better than any thermonuclear fusion machines until quite recently, it was immediately apparent to the researchers that they could never reach break-even. The reason, quite simply, was that either configuration required grids, and grids simply could not be built more than about 98% transparent and be expected to support their own weight, especially as they typically run red hot when fusion conditions are achieved. The machines seemed doomed to operate at no more than 0.01% of

break-even. A few researchers struggle on, tantalized by the fact that the machines seem to have modes of operation which are better than theory predicted. Dr. George Miley of the University of Illinois has shown that a "star mode" develops in which recirculation passes primarily through the grid openings, reducing grid losses (his group's "Fusion-Star" design, developed with Daimler-Chrysler, is commercially available for use as a neutron source). There also appears to be considerable fusion occurring immediately outside the convergent focus region, where head-on collisions dominate, which was neglected in early analysis. Still, these improvements fall far short of what is needed for a power reactor.

Basically, the grids had to disappear!

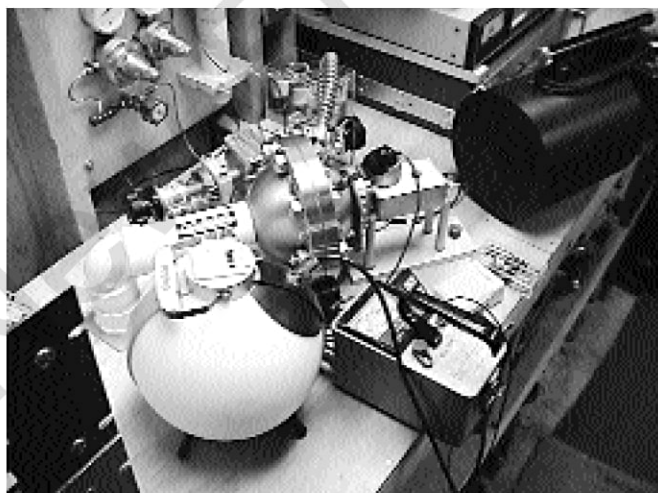
A way may be forthcoming. The actual inventor of the scheme below asked me to drop my original glowing testimonial. He is entirely too modest, if you ask me, but I understand his motives. Still, he isn't getting off without his name and at least a few of his extensive accomplishments being mentioned here. You may have heard of him as the inventor of the interstellar ramjet concept featured in *Tau Zero* and many other science fiction stories: Dr. Robert W. Bussard. In the 1950s, he proposed and designed a workable nuclear fission rocket engine, KIWI-A, the first predecessor of NERVA. KIWI-A was ready to test *before Sputnik was launched*.

Dr. Bussard also worked with Dr. Hirsch in the thermonuclear fusion program at the old Atomic Energy Commission, predecessor of the DOE. Both of them recognized the finer points of the IEC machines and wondered if a way could be found to get around the grid problem.

When life hands you a lemon, it has been said, you should make lemonade. Bussard was struggling with another of his inventions, a small tokamak called the Riggatron, which looked marginally workable but had turned out to be far too expensive to build with the available money. The enormous energy required to bring the magnets up to a field strength that would trap the plasma would require a monster flywheel-generator that was simply way over budget. The problem with tokamaks, he realized, was that ions are so damnably hard to trap with magnetic fields, particularly under fusion conditions. Yes, by using superconductors or putting copper coils very close to the plasma and pushing them to their limits, it was possible to trap light ions like deuterium and tritium, but as soon as they collided they tended to jump field lines, unless the fields were especially powerful. Achieving that field strength turned out to be a killer problem, especially lacking the financial resources of a major government.

It was a pity, Bussard thought, that ions are not as simple to trap with magnetic fields as are electrons. Because electrons are thousands of times lighter than fusion fuel ions, they are deflected easily by much weaker magnetic fields. If the little tokamak contained only electrons, they could be held at high energy and density quite efficiently. And then an epiphany struck.

It might just be possible to build an EXL machine with magnetically insulated grids. The magnetized grids⁸ would accelerate electrons just as well as wire grids, but it would be next to impossible for the electrons to actually



Richard Hull's third generation fusor, "Fusor III."

Photos courtesy Richard Hull.



Reaction zone of DD fusion within the inner grid inside "Fusor III."

hit the grid. Ions formed just inside the grid would be drawn into the potential well and oscillate until they collided, totally unimpeded by grids and trapped by the *one* thing (other than the gravity of a star) that holds them vigorously—an electrostatic potential. From time to time, theory seemed to pose a fatal obstacle, but each time a closer analysis of the obstacle revealed a solution that made the theory work even better.

Funding was found to build a large-scale (one meter radius) machine, which demonstrated that the system could produce a deep potential well. Further small-scale work showed successful magnetic trapping of dense electron clouds. Theory and computer simulation seem to support the models and experiments with no roadblock problems found, yet.

The theory and preliminary lab studies look good. A few million dollars would fund a working prototype, and if that doesn't work, indications are that scaling up a factor of ten in volume almost certainly would. While not cheap for most of us, compared to the DOE budget for the last twenty years it is practically petty cash. Will it succeed? At this point, only time will tell.

The Possibilities

If successful, the impact of this type of reactor would be enormous. I need not describe the overall economic consequences in too great a detail to this audience: science fiction is chock full of stories in which we developed cheap, clean fusion to replace petrochemical fuels and to power our spacecraft. *Infinite Energy* is premised on the notion of the need for potent alternative energy sources, and a lot of *Infinite Energy's* readers also subscribe to *The Electric Spacecraft Journal*. However, Bussard's magnetic-grid EXL version of the Fusor shows promise as a power source that sounds like science fiction. One reason is that it doesn't have to run on nasty neutron-producing fuels like deuterium and tritium.

As mentioned earlier, there are many nuclei which can produce net fusion energy besides deuterium, tritium, and helium-3. Most of them are not commonly discussed, because they require far higher collision energies than DT reactions. Since DT reaction conditions themselves are a formidable challenge for *thermo*-nuclear approaches, the other fuels are simply out of the question for tokamaks or IEC systems. These limitations become almost trivial in IEC devices, however. By simply jacking the voltage up to a couple hundred kilovolts, the electrons can be made to produce a deeper potential well, and the ions race to the focus region faster. This requires scaling up the hardware, but does not appear to require any great leaps of technology.

Among the fusion fuels is a favorite of Dr. Bussard: the reaction between ordinary hydrogen nuclei (protons) and boron-11. Boron can be mined as borax or other minerals and is readily extracted from seawater. About 80% of natural boron is the boron-11 isotope. The fuel is plentiful.

The p-B¹¹ reaction is ideal: when the two nuclei fuse, they form excited carbon-12, which is unstable and almost immediately begins to fly apart. In two rapid stages, it casts off an energetic alpha particle (a helium nucleus), then the remaining nucleus splits into a *pair* of alpha particles. The first particle carries 43% of the reaction energy, and comes off at precisely 3.76 million electron volts, which turns out to be very handy. The other two alphas come off at an average of 2.46 million electron volts each, over a spread of energies. Finally, the reaction produces no neutrons or high-energy gamma rays. There is a little bremsstrahlung radiation (basically X-rays) from collisions associated with the reaction, easily shielded. Alpha particles are dangerous if produced in your body, but can be stopped by the thinnest of shields and are essentially harmless in a reactor vessel. Once they pick up two electrons, alpha particles become helium, a harmless inert gas. There is no radioactive waste produced in this reaction!

Lithium can also undergo similar reactions, producing charged particles, and is an alternative fuel for such a reactor.

Most nuclear power generation systems produce heat by one mechanism or another, which is in turn used to heat a "working fluid" to run turbines or otherwise do mechanical work. The process of converting heat to mechanical energy by such means is inherently inefficient. Rarely does more than about a third of the energy end up in useable electrical or mechanical form, and the theoretical limit is around 40% for most practical fluids, engine materials, and operating temperatures. This fact has depressed thermodynamics students for the last century or so, but there appears to be no getting around it using primitive "Promethean" technology.

While you *could* simply allow the alpha particles from the p-B¹¹ reaction to slam into the reactor walls producing heat, there turns out to be a much better way to extract their energy. Alpha particles, which are helium atoms stripped of their two electrons, have a charge of +2. Each of the particles produced by this reaction has a kinetic energy of around three million electron volts. An electron volt is the energy a particle of charge 1 will pick up when accelerated through a field of 1 volt. The reverse is true, too. To slow down a 3 MeV particle with a charge of +2, simply decelerate it with a +1.5 million volt electric field. The particle will just kiss into the charged surface and draw two electrons from it, producing current at high voltage. This method has been used to extract small amounts of power from alpha-emitting radioactive substances and should also work for a large reactor of the correct configuration. The correct configuration is a spherical vacuum chamber (which this reactor just happens to be) with several charged grids to pick off the lower energy alphas, and the outer walls charged to catch the high energy alphas. It should be possible to approach 95% conversion of fusion energy to electricity with such a system (the rest being lost as bremsstrahlung radiation and a few other minor mechanisms). This is quite remarkable—a nuclear reaction which allows almost all of the energy produced to be *directly converted* to high-grade electrical power!

You might think that if nuclear energy is so cheap, efficiency would not be a problem. For power plants, particularly large ones, waste heat release can cause local environmental changes, either by heating a body of cooling water or causing local weather changes when water-mist cooling towers are used. The cooling apparatus is generally massive and can easily cost more than the actual power-generating equipment!

Waste heat in spacecraft is even more serious. Any nuclear-electric power plant using gas turbines or similar equipment *must* get rid of the excess heat in order to operate. Since there is no air or water in space to conduct away the heat, it must be radiated. For a thermal-cycle reactor of sufficient power to operate even a modest manned spacecraft, the radiators will be on the order of the size of football fields. They end up being a huge portion of the dry mass of the spacecraft, and simply *ruin* the performance. Thus, a reactor that can produce electrical power directly, at 95% efficiency, has a *tremendous* performance advantage over its thermal/mechanical/electric counterpart.

Dr. Bussard has done some preliminary design studies on spacecraft that could realistically be built around p-B¹¹ reactors. Most use a large and very powerful reactor of close to ten billion watts capacity, typically with two reactors for redundancy. While fairly bulky, with a diameter of around five meters, the reactor is mostly empty vacuum, with only the MaGrid™ and a few electron and ion guns in it. It is thus exceptionally light for the power produced. Supporting cryogenic and power conversion equipment should also be practical space hardware and not especially massive.

Because the reactor produces no radioactive waste and only

a trace of radiation, it will be safe to operate in the atmosphere. Using high-voltage electron beams to superheat gas, one could build either an air-breathing jet or a rocket (relying on on-board reaction mass). In space, the rocket configuration will be used. Because the reactor can work only if there are far more electrons in it than fuel ions, it is also "intrinsically safe"—if you feed it too much fuel, it just chokes off.

There are many ways of exploiting the EXL reactor output to produce rocket thrust, but the fact that the p-B¹¹ power plant produces high voltage electricity makes it particularly suited for arc-jet propulsion's meaner big brother. In a million-volt-plus electron beam the electrons are pushing light speed, so the term relativistic electron beam (REB) is used. With some heavy-duty research and development, it is expected that REB heating can be made quite efficient and should be able to impart high velocity to the reaction mass. Water would be a perfectly suitable reaction mass, as would almost any other handy and abundant material. REB's are not picky about what they blast to plasma. Dr. Bussard calls the REB-heated systems "QED" (Quiet Electric Discharge) engines.

For longer range missions, where quick acceleration is less important, a more efficient rocket which uses the fusion exhaust directly, with some reaction mass added, could be built. This would be the system of choice for trips to the outer planets or even out to the Oort cloud. Dr. Bussard calls these more efficient systems "DFP" (Diluted Fusion Product) engines.

What kind of performance could realistically be achieved? Try these figures from some of Dr. Bussard's papers!^{9,10,11}

- 1) Low Earth Orbit (LEO) to Mars: thirty-three days, more or less, for high performance designs, or six weeks for economical freight-hauling variations. The craft are single-stage, with a 15% to 20% payload fraction.
- 2) LEO to Saturn's Moons: as low as two months, with a short coasting period. Again, the craft is single-stage, and has a 14% payload fraction.

How would such a rocket affect the economics of space exploitation? Most estimates you have heard in the past were for single-use, multi-staged, chemically-propelled rockets, which can barely achieve Earth orbit, the upper stage of which must limp to the planets along painfully slow Hohmann ellipse orbits. Chemical rockets are almost all fuel and barely any payload. While rocket fuel is fairly cheap, rockets are not, and each flight has a high operating cost in labor and hardware. Dividing the cost of a large rocket by a payload mass somewhere just above zero gives a really depressing cost per kilogram. Efficient fusion-powered rockets, reusable for many flights, fast enough to make many flights before becoming obsolete, and with a high payload for each mission, can improve economics by several powers of ten. Consider the following colonization figures extracted from a more recent paper by Dr. Bussard,¹² and I recommend you read these sitting down:

- 1) Cost to LEO: \$27/kg (a price that compares favorably to the cost of riding the Concorde across the Atlantic).
- 2) Four thousand people on Earth's moon, each person with twenty-five metric tonnes of equipment, and each person receiving an annual visit back to Earth: \$12 billion over ten years.
- 3) Twelve hundred people on Mars, each with fifty tonnes of equipment, and an annual visit back to Earth: \$16 billion over ten years.
- 4) Four hundred people on Titan [Saturn's moon], each with

sixty tonnes of equipment, and an annual visit back to Earth: \$16 billion over ten years.

I leave you to ponder these figures, particularly in light of the projected costs of sending a few people to explore Mars using chemical rockets, typically estimated on the order of \$100 billion per trip. In particular, consider what these numbers would mean to your personal chances of living and working in space.

References

1. Gillette, S.L. 1993. "Beyond Prometheus," *Analog*, December.
2. "Nucleus," *Encyclopedia Britannica*, 1955, v 16, p 589, re, the "cascade transformer" of Lauritsen, Crane, *et al.*, and later work by Cockcroft and Van de Graff.
3. Langmuir, I. and Blodgett, K.B. 1924. "Currents Limited by Space Charge Between Concentric Spheres," *Physics Review*, 23, 49-59.
4. Farnsworth, P.T. 1966. U.S. Patent No. 3,258,402, issued June 28.
5. Elmore, W.C., Tuck, J.L., and Watson, K.M. 1959. "On the Inertial-Electrostatic Confinement of a Plasma," *The Physics of Fluids*, 2, 3, May-June.
6. Hirsch, R.L. 1967. "Inertial-Electrostatic Confinement of Ionized Fusion Gases," *Journal of Applied Physics*, 38, 11, October.
7. Strong, J. 1938. *Procedures in Experimental Physics*, Prentiss-Hall; reprint 1986. Lindsay Publications Inc., Bradley, Illinois.
8. Bussard, R.W. 1989. "Method and Apparatus for Controlling Charged Particles," U.S. Patent 4,826,646, Issued May 2.
9. Bussard, R.W. 1990. "Fusion as Electric Propulsion," *Journal of Propulsion and Power*, 6, 5, September-October, 567-574.
10. Bussard, R.W. and Jameson, L.W. 1994. "From SSTO to Saturn's Moons: Superperformance Fusion Propulsion for Practical Spaceflight," 30th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, June 27-29, AIAA 94-3269.
11. Bussard, R.W. and Jameson, L.W. "Inertial-Electrostatic-Fusion Propulsion Spectrum: Air-Breathing to Interstellar Flight," *Journal of Propulsion and Power*, 11, 2, 365-372.
12. Bussard, R.W. 1997. "System Technical and Economic Features of QED-Engine-Driven Space Transportation," 33rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, July 6-9, AIAA 97-3071.

About the Author

This article won the 1999 Analab award for best science fact article in *Analog* magazine in 1998. Tom Ligon is an engineering technologist with degrees in Biology and Electrical Engineering Technology from Virginia Tech, with additional coursework in Health Physics and undergraduate research in Chemistry. He has worked in instrument design and general laboratory testing since 1979, and recently became an independent consultant. Tom is a science fiction writer, and his name crops up occasionally in *Infinite Energy* in connection with the Marinov motor.

*E-mail: TomLigon@compuserve.com.

ENECO

**ENECO is in the business of
commercializing the exciting new
field of low energy induced nuclear
reactions in solids.**

**University of Utah Research Park
391-B Chipeta Way, Salt Lake City, Utah 84108
Ph (801)583-2000 Fx (801) 583-6245
jaeger@ENECO-USA.com**

My Impressions as a NEDO Guest Researcher at the NHE Laboratory in Japan

Melvin H. Miles*

Introduction

My assignment as a NEDO (New Energy Development Organization) guest researcher at the NHE Laboratory in Sapporo, Japan, ranks as one of the highlights of my scientific career. This was a very enjoyable experience, and I was treated very well by Dr. N. Asami and everybody else working in the program. It is difficult for me to be critical of the people involved with this program, but unfortunately I do feel they made mistakes.

I have never worked with a group of people that got along together so well. In the Japanese culture, there is always respect for the other person and never any public display of contention or anger. Even in automobiles, the Japanese are always courteous to each other. They only use the horn to signal another driver that he may cut in front. I enjoyed the various social events of my work group, which included many dinners, an evening of bowling, and a weekend ski trip. I think everyone worked very hard on this project, but obtaining positive cold fusion results was not an easy task.

NHE Personnel

The head of the program was Dr. Naoto Asami, who has a Ph.D. in physics. His main interest was in material science, and the NHE Laboratory probably performed more material studies on the palladium-deuterium system than any other laboratory in the world. Dr. Asami was one of the best supervisors that I have ever worked with. He gave me almost complete freedom on the studies that I selected to do in Japan. He seemed to keep everything running smoothly, and the lab was well-organized. Dr. Asami was very good with people and in managing the laboratory, but his scientific range was narrow for the cold fusion field and his understanding of calorimetry and electrochemistry was limited. However, I liked his relaxed and casual manner. He generally wore blue jeans to work, hence everyone else also dressed casually.

For my calorimetric studies, I worked mainly with Masao Sumi, especially in setting up the Fleischmann-Pons type studies. Mari Hosoda, a laboratory technician, helped me by polishing samples and preparing solutions. She spoke English reasonably well and was able to answer almost any questions that I had concerning preparations for my experiments. I worked with Mari mainly in the material treatment and assembly room. Mari was also kind enough to give me a ride to and from work until she left the laboratory at the end of February. Shigeru Miyashita was the computer expert and also performed tritium analysis. The other people from Japan that I worked with include Hiroshi Kamimura, Ryoichi Shimada, Akihiko Kubota, Toshio Senjuh,

and Hiroyuki Shimada. They are all engineers, not research scientists. Another engineer, who left before I arrived in Japan, was Elliot Kennel of the U.S. The only research scientists in this program were Dr. Andrei Lipson from Russia, Dr. Paolo Tripodi from Italy, and myself. It is interesting to note that the three research scientists reported positive results for this program, the engineers did not, and these positive results all came near the end of this program. A summary of the results for each research scientist is presented at the end of this report. Completing the NHE team was Tomio Uehara, an assistant to Dr. Asami; Kaoru Iida, the secretary; and Risa Katano, a laboratory technician who helped prepare many of the experiments at NHE.



The NHE Laboratory Group — Back row from the left: Dr. Miles, Dr. Lipson, and other researchers; Middle row from the left: Dr. Asami and other researchers; Kneeling from the left: Dr. Tripodi and another researcher.

Results of the NHE Program

The following four points were stated as the purpose of the NHE project:

- 1) To confirm and demonstrate excess heat generation phenomena.
- 2) To make clear the heat generation mechanism.
- 3) To make excess heat generation controllable.
- 4) To clarify the feasibility of new hydrogen energy (cold fusion) as a future energy source.

None of these goals were achieved despite the \$30 million budget, which is why the project was not continued, according to statements made to the press by the project leaders. During the last week of March 1998, the number of employees was reduced to only Dr. Asami and his assistant to complete the final reports. However, my final report shows evidence for small amounts of excess power similar to what I measured in China Lake. Omitting two control studies, I observed excess heat in eight out of ten calorimetric experiments in my isoperibolic calorimeters. This 80% success rate is the highest that I have ever obtained. Dr. Lipson and Dr. Tripodi also found some positive results. Objectives 2, 3 and 4 were never reached during this four-and-a-half-year program. The much smaller Navy program also failed to resolve objectives 2-4. There were many experiments, however, that produced excess heat at China Lake.

My impression of this program is that the engineers did excellent work in duplicating other people's experiments but did not come up with many new ideas. For example, the SRI flow calorimetry system was very impressive, but no excess heat was ever measured with it. My opinion is that this calorimetry is too static and does not allow sufficient variation in the cell temperature for good results. Nothing very original was tried in the Fleischmann-Pons (F/P) calorimetry, and there were far too few experiments attempted with this system. Furthermore, they developed their own data analysis based on a single calibration, and this was not very accurate. They failed to

do averaging techniques for the F/P cells that are essential to obtain accurate results. Their treatment of my F/P data failed to show any excess heat effects, but my averaging techniques showed that small excess power levels were present in two cells out of three. In my opinion, the Japanese work was inadequate with respect to the F/P calorimetry.

By the time I arrived at NHE, I sensed that the Japanese engineers were discouraged and did not believe that any cold fusion effects were real. This is not an easy area of research and can be very frustrating since effects are often small. When I first told Asami and Sumi in November that I was detecting excess heat in Cell A, I was quite surprised by their lack of enthusiasm. It seemed to me that they were really thinking that this was just another mistake. Sumi commented to me that NEDO wanted large effects and would probably not be influenced by reports of small excess power although these would still be of scientific interest. Sumi left the program a week before I did, and at the farewell party he stated that he believes that there is something real to cold fusion, but it is going to take a lot of work to find out exactly what is going on.

I believe Asami has an open mind for this research and would have liked to have the program continue. He seemed sad that this program was ending. However, it must have been frustrating for him since positive results were so difficult to achieve. If the program had more research scientists, or if Lipson, Tripodi, and myself could have begun our work earlier, things might have been different. New approaches should have been tried sooner for the excess heat effect, such as the fluidized bed approach, co-deposition, and electromigration. I would have liked to have had more time to investigate variables relating to these three areas. Research scientists should have been working at this laboratory at the beginning of the NHE program, then the engineers could have followed up on their results. My final conclusion is that engineers are not the right type of scientists for this area of research at the present time. Too many questions must be answered before the engineers are needed. Nevertheless, they were all great people, and I hate to criticize any of them. They certainly worked hard and gave this program their best effort. There are no simple answers that explain the excess heat generation mechanism and no easy path, based on previous methods, for making the excess heat generation controllable. In my opinion, the fluidized bed and electromigration experiments offer the best hope for a possible solution to the reproducibility problem. Progress will continue to be very slow due to the lack of funding for this research.

Summary of Report by Elliot Kennel

I found Elliot Kennel's report to be quite negative and very controversial. He returned to NHE early in March to complete his report and also gave a presentation on March 6, 1998, at the final NHE meeting. In my opinion, his presentation contained very little substance—virtually nothing was reported representing his own experimental work despite the fact that he worked at NHE for sixteen months (June 1, 1996 to September 30, 1997). His presentation included statements that Lipson's experiments demonstrated no positive results due to low statistical evidence, that isoperibolic calorimetry shows excess heat while flow calorimetry shows none, and that Ed Storms' excess heat decreased when he improved his calorimetry. He did comment that the recent work by Dr. Kasagi and Dr. Takahashi looks promising, but they were both at this meeting. I was quite surprised that he said nothing about his own research work at the NHE Laboratory. My impression of Kennel is that he is an engineer, not a research scientist, and more of a politician than a sci-

entist. Lipson and Tripodi had even stronger feelings about Kennel. They both targeted him for some rather sharp comments in their final reports. Tripodi thought that politics were behind Kennel's negative opinion towards cold fusion. He suggested that perhaps NEDO and IAE wanted these negative opinions to justify their ending of this program.

Kennel's final report contains many controversial conclusions. He states that a review of past efforts in excess heat, radiation detection, and nuclear ash detection reveal that there are many ways to generate false positive signals. He states that excess heat is likely due to calorimetric artifacts rather than anomalous nuclear reaction. He is especially critical of Fleischmann and Pons and states that their published results do not provide enough rigorous information to inspire confidence in their calorimetric results. He states that NHE Laboratory tests were unable to obtain values of thermal output accurate to within 20% in some cases using the F/P calorimetry. In my opinion, he is totally wrong in making these statements. If the F/P cells are not properly calibrated, then a 20% excess heat effect may look like a $\pm 10\%$ error in the calorimetry. The baseline for zero excess power, and hence the calorimetric cell constant, must be accurately determined. Prior to my arrival, the NHE researchers using F/P cells relied only on one calibration at the beginning of the experiment; furthermore, they failed to do data averaging of the cell temperatures, bath temperatures, cell voltages, and other measurements that are essential for accurate calorimetric results. The F/P cells have a time constant of about ninety minutes; therefore, they respond slowly to any changes in the cell conditions. For example, if I added heavy water or increased the cell current, it took nearly six hours to reestablish steady state temperatures. A variation in the measurement of the cell temperature of only $\pm 0.01^\circ\text{C}$ would produce an apparent calorimetric error of $\pm 16\text{mW}$ in the excess power measurement. This apparent error is easily removed by averaging techniques. One remarkable feature of the F/P calorimetry is its ability to average any changes to the cell over rather long time periods. Therefore, any treatment of the calorimetric data must also involve extensive averaging. The publication by T. Saito *et al.* from the NHE Laboratory in *ICCF-5*, 1995, pp. 105-111, is also in error for these same reasons. Kennel used this reference to support his statements about calorimetry in his final report.

Kennel's report suggests that helium-4 can be due to contamination in the laboratory or due to an artifact involving the turbomolecular pump. I cannot see where his comments could possibly apply to our helium measurements conducted at two commercial laboratories specializing in these measurements.

Kennel also states that the combination of neutron irradiation and electrolysis did not induce any observable nuclear effects. Lipson, of course, took strong issue with this statement and replied to this in his report. Lipson claims that his results are quite significant and have a confidence level greater than ten standard deviations above background levels. Lipson asks in his final report how it was possible that Kennel did not see this obvious effect. He also asked, "Was this elementary inattentiveness or was it intentional falsification of the data obtained?"

Kennel also attacks the electromigration studies. He claims that the proton current in palladium wire is orders of magnitude lower than claimed by Celani *et al.* in their experiments. Tripodi, of course, did not like this statement and replied to this in his final report. He states that Kennel produced the wrong experimental set up for electromigration studies and wrote incorrect things concerning this method. Tripodi concludes his report stating that, "I don't know why he [Kennel] produced this kind of mistake, maybe it is only misinformation or politics."

My own impression of Kennel's final report is that he tries to be an expert in all areas regarding cold fusion. He certainly was incorrect in his statements regarding the F/P calorimetry. Other than my disagreements with him concerning his final report, I found Kennel to be a nice person and appreciated his help in arranging for my position in Japan.

Summary of Report by Dr. Paolo Tripodi

I enjoyed my association with Tripodi at the NHE Laboratory and collaborated with him in pulse electrolysis experiments as well as in electromigration studies. He is personally outgoing and fun to be around. The following six points summarize his final report:

- 1) He found evidence for helium-4 in palladium samples in amounts that were more than 100 times greater than the background. These amounts, however, are too low to explain the excess heat observed. He reports a rate of 7.6×10^{-14} fusion per second per DD pair.
- 2) His experiments produce evidence that there is an electromigration effect for D^+ in palladium.
- 3) His experiments at NHE produced excess heat of 2 W or 8% more than the input power using the thin palladium wire geometry.
- 4) His report stresses the necessity for dynamic conditions in order to produce the excess heat effect. Electromigration gives the dynamic conditions required. In addition to high deuterium loading in the palladium, there must be changes in this loading with time and with spatial coordinates of the cathode.
- 5) Surface studies show that deuterium atoms enter the palladium lattice through grain boundaries and then diffuse inside the grain. The use of on/off electrolysis conditions hinders the deuterium evolution from the grain surfaces and thus produces an increase of the loading ratio.
- 6) He reports a power density of 250 W/cm^3 from his electromigration experiments. This value is very similar to my measurement of 190 W/cm^3 in my electromigration experiment. However, Tripodi stresses in his report that the excess heat effect is really not a volume effect but rather a surface or skin effect.

Tripodi and I planned on the analysis of my Pd-B and Pd-Ce electrodes that produced excess heat for the presence of helium-4, but we ran out of time and were unable to do this study.

Summary of Report by Dr. Andrei G. Lipson

Lipson worked at NHE for fourteen months, hence his report is rather long. His focus is on nuclear emissions to confirm the existence of Lattice Induced Nuclear Reactions (LINR) or "cold fusion." His experiments were mainly concerned with Au/Pd/PdO:D heterostructures. The following six points summarize his main results:

- 1) Perhaps the most important result is the study at Tohoku University with Dr. Kasagi. These experiments show that the irradiation of Au/Pd/PdO:D heterostructure with low-energy deuterons show an enhancement of the DD fusion rate by a factor of fifty at a deuteron energy of 2.5 keV. This is very strong evidence that the metal lattice can affect fusion rates.
- 2) Lattice Induced Nuclear Reactions were observed using the Au/Pd/PdO:D heterostructures under conditions of exothermic deuterium desorption.
- 3) The emission of protons and neutrons are almost the same, thus there is no essential difference between the channels of the DD-reaction under his experimental conditions and those observed for hot fusion. (This result, however, differs from many other reports. Perhaps this is due to the spe-

cial conditions of his experiments).

4) The mean rate of the DD-reaction is of the order of 10^{-24} per second per DD-pair. This level of reaction, of course, can not explain the production of excess heat.

5) It was established, by the use of Cr-39 track detectors, that his heterostructures emit fast neutrons of very high energy (up to 20 MeV). He believes that these results could be related to the three body fusion (DDD) proposed by Dr. Takahashi of Osaka University. (Lipson conducted some experiments at Takahashi's laboratory.)

6) Lipson employed a combination of weak thermal neutron irradiation and electrolysis. This showed a sharp increase of thermal neutron capture probability in strained Pd samples. There was no effect in annealed Pd samples.

I found Lipson to be a dedicated research scientist willing to work many extra hours in his pursuit of evidence for cold fusion. He collaborated with a number of scientists outside the NHE Laboratory, which included Dr. Mizuno of Hokkaido University, Dr. Takahashi of Osaka University, and Dr. Kasagi of Tohoku University in Sendai.

Summary of Report by Dr. Melvin H. Miles

My most important result is probably the observation of excess heat using small palladium particles in trying to produce a fluidized bed experiment. This excess heat increased with time and reached levels of about 300 mW with the use of pulse electrolysis. A similar experiment using platinum particles produced no excess heat. This approach may be the breakthrough needed to produce a reproducible effect. Further research, of course, is needed to demonstrate that this is correct. The experimental results are no longer controlled by a single piece of metal since this is replaced by many tiny palladium particles. Furthermore, the movement of these particles due to the gas evolution continually produces the dynamic conditions needed for the excess heat effect. The surfaces of palladium particles exposed to the electrolyte are constantly changing, hence the degree of loading in each particle is also changing.

My studies at the NHE Laboratory produced excess heat in eight out of ten experiments. Two other experiments which were designed as control experiments, and did not produce excess heat, and one other test with active material failed because of prosaic equipment problems. Hence, my real success rate for the production of excess heat was eight out of ten experiments, or 80%. This is the highest success rate that I have experienced in cold fusion studies. This high success rate was partially due to selecting cathode materials that had previously produced excess heat or that were similar to successful alloys (Pd-B) produced by the Naval Research Laboratory. New techniques that produced dynamic conditions such as the use of small palladium particles (fluidized beds) or thin palladium wires (electromigration) contributed to my high success rate for excess heat.

The following points summarize my experimental results in Japan (See p. 22 for Miles' report.):

- 1) Results in agreement with previous experiments at China Lake were obtained using two Johnson-Matthey palladium cathodes. Excess power levels of about 100 mW were obtained for the cathode that previously produced excess heat at China Lake. The other electrode gave no excess power, in agreement with previous results at China Lake.
- 2) Strange temperature excursions were observed for the thermistor positioned directly in line with the cathode in the cell that produced excess heat. This suggests electromagnetic or charged particle emissions from the cathode that affect the resistance or voltage of the thermistor. The effect was too

rapid to be attributed to real temperature excursions. Nevertheless, there was some type of emission from the cathode that was affecting the thermistor. From discussions about these results, Lipson suggested electro-magnetic radiation, and Tom Passel proposed that X-rays could cause this effect.

3) Experiments using the F/P cells produced excess heat for a Pd-0.5 B alloy and for a Pd-Ce alloy. The levels of excess power were 100 to 200 mW. A third experiment using a Pd-Ce-B alloy produced no excess heat. The Pd-Ce alloy was obtained from Martin Fleischmann and had produced excess heat in a previous experiment at China Lake. The Pd-0.5 B was from NRL and similar samples had been very successful in producing excess heat at China Lake. The Pd-Ce-B alloy was also from NRL but had never been tested in any previous experiments.

4) A modification of the Szpak co-deposition method produced excess power in all three cells of the F/P type. It was not possible, however, to completely rule out recombination as a source for the excess heat. (I consider this unlikely.)

5) Electromigration experiments involving a thin palladium wire produced excess power that averaged about 150 mW or 190 W/cm³. This result is similar to experiments reported by Tripodi.

Conclusions

Most critics of cold fusion will surely concentrate on the fact that the NHE program was closed down and that their studies of cold fusion, therefore, were a failure. This will certainly influence the status of cold fusion in the minds of many scientists. However, they will fail to recognize that the major goal of this program

was to produce a new energy source rather than to do basic research on this new science. As Tripodi stated in his report, it is clear that basic research is needed to improve cold fusion and that the engineering approach used at NHE to "produce energy is a misunderstanding at this time." I have spoken with Michael McKubre since I returned and he has the same opinion. He has worked quite closely with people from the NHE Laboratory. I have also spoken by telephone to Martin Fleischmann. He has very strong feelings that this entire NHE program in Japan was a big mistake and that it has reflected badly on the cold fusion field. There is one major positive aspect of this program, however, that should be emphasized. This is the fact that Lipson, Tripodi, and myself were the only three research scientists to work at NHE. All three of us produced positive results and essentially reproduced our previous results. This research has produced strong evidence that fusion reactions can be enhanced by the metal lattice. Furthermore, the use of small palladium particles in a fluidized bed configuration based on my studies at the NHE Laboratory may lead to a reproducible effect. Electromigration experiments by both Tripodi and myself also provided evidence for excess heat production.

It is my opinion that the NHE program would have been much more successful if research scientists had been involved from the beginning rather than for the final six to twelve months. For example, my new methods and results could have provided the needed breakthrough if this program had continued. The feasibility of this new hydrogen energy (NHE) or "cold fusion," as a future energy source remains an open question.

About the Author



Melvin H. Miles received his two year college degree from Dixie College in St. George, Utah, where he was valedictorian of his class. After serving two years as a missionary in Germany for his church, he continued his education at Brigham Young University, where he received a B.A. degree with a major in chemistry and a minor in mathematics. He then continued graduate school at the University of Utah, where he received a Ph.D. with a major in physical chemistry and a minor in physics. Following this he was a NATO post-doctoral fellow at the Technical University in Munich, Germany (1965-66).

Miles was then a research chemist for the Navy at the Corona, California laboratory (NOLC). He left this position in 1969 to teach at Middle Tennessee State University (MTSU). He was there for nine years; he was an assistant and then associate professor with tenure. During this time he spent summers doing research at either Brookhaven National Laboratory in Long Island, New York, or at the Naval Weapons Center in China Lake, California.

He accepted a permanent position at China Lake in 1978 and has been there since that time. He has over 150 research publications in various areas. He received the NAWCWP Fellow Award for his research in China Lake along with the McLean Award and the Sigma Xi Award for his scientific publications. He was engaged in cold fusion work in China Lake from 1989 until 1995. He worked in Japan for five months at the NHE Laboratory in 1997-98 as a NEDO Guest Research Scientist. *NAWCWD, Code 4T4220D, China Lake, CA 93555; e-mail: milesmh@navair.navy.mil or melmiles@ridgecrest.ca.us.

FUSION and OTHER NUCLEAR REACTIONS IN THE SOLID STATE

Volume 2 - Calorimetric Complications [Includes: "LESSONS FROM OPTICAL EXAMINATION OF the PFC Phase-II CALORIMETRIC CURVES"]
 Edited by Dr. Mitchell Swartz
 JET Technology Press (Wellesley, MA)
 ISBN 1-890550-02-7, March 1999
 (60 pages, 8 color figures) The book is part of a series.

\$32.95 North America

\$37.95 Foreign

(Includes shipping/handling)

Available from Cold Fusion Technology

P.O. Box 2816

Concord, NH 03302-2816

Phone: 603-228-4516 Fax: 603-224-5975



Anti-Gravity News and Space Drive Technology

Quarterly publication reporting on current developments and experiments leading to practical control of gravity, as well as inertia modification and propulsion. James E. Cox, Editor (775)323-5796 ext. 127 Ron Kita, Assoc. Editor (215)345-0461

Subscription \$24/yr USA, \$28 CA/MEX and \$32 Foreign; \$10 ea. back issues.

Payable to James E. Cox, Enterprise, P.O. Box 71151, Reno, NV 89570-1151 USA

Website pradur.com/agm/

Report on Calorimetric Studies at the NHE Laboratory in Sapporo, Japan

Melvin H. Miles*

Abstract

Experiments using China Lake-type calorimetric cells produced excess power in three out of three experiments and no excess power in three control studies. A detailed analysis is presented for two experiments using the China Lake cells. Anomalous thermistor signals in Cell A suggest the emission of electromagnetic radiation from the active palladium cathode. Another set of experiments in Fleischmann-Pons (F/P) type calorimetric cells produced excess power in six out of eight experiments (the equipment failed during one other test). These studies involved palladium-alloy cathodes, co-deposition of palladium and deuterium from the solution, and electromigration using thin palladium wires.

Introduction

The New Energy Development Organization (NEDO) of Japan made it possible for me to return to cold fusion research and perform calorimetric experiments for a five-month period (October 1997 to March 1998) at the New Hydrogen Energy (NHE) laboratory in Sapporo, Japan. Two types of isoperibolic calorimeters were used in these studies:

- 1) China Lake type calorimetric cells where the heat transfer is mainly by conduction, and
- 2) F/P Dewar type cells where the heat transfer occurs mainly by radiation.

The main focus here will be on the China Lake calorimetric cells that are operated at constant current conditions where the complex calorimetric equations can be greatly simplified. The increase in excess power is then readily apparent by the corresponding increase in the cell temperature. A detailed analysis of the results for one experiment using the F/P calorimetric cells will be presented elsewhere.¹ The NHE laboratory provided excellent facilities for cold fusion research. However, all experimental work at NHE ceased on March 12, 1998, due to the decision to close this laboratory. It was sad to witness the dismantling of this laboratory and the transfer of personnel to other positions, as well as the termination of my own experiments.

Experimental

The basic China Lake calorimetric design has been described in previous publications.²⁻⁴ The small electrochemical cell consists of a long, narrow test tube (1.8 cm diameter and 15.0 cm length) that is filled with 18.0 cm³ of 0.1M LiOD in D₂O (Isotec, Inc. 99.9 at.% D). The electrochemical cell is placed in a calorimetric jacket within a secondary compartment that contains two thermistors positioned on opposite sides of the cell wall and at different heights from the bottom of the cell (1.9 cm and 4.5 cm). Figure 1 shows a schematic of the positioning of the two thermistors relative to the palladium cathode rod (1 mm x 20 mm) and the platinum anode coil.

It is important to note that the thermistors are placed on the outside wall of the electrochemical cell rather than in the D₂O + LiOD electrolyte. Aluminum foil was wrapped around the outside of the cell, including the two thermistors. The secondary compartment was packed with aluminum foil, insulated at the top, and then sealed with silicon rubber. Two similar cells were prepared (Cells A and B), placed in a constant temperature water bath, and run in series at constant current. Thermistor channels T₁ and T₆ were used for Cell A and T₃ and T₄ for Cell B. The tem-

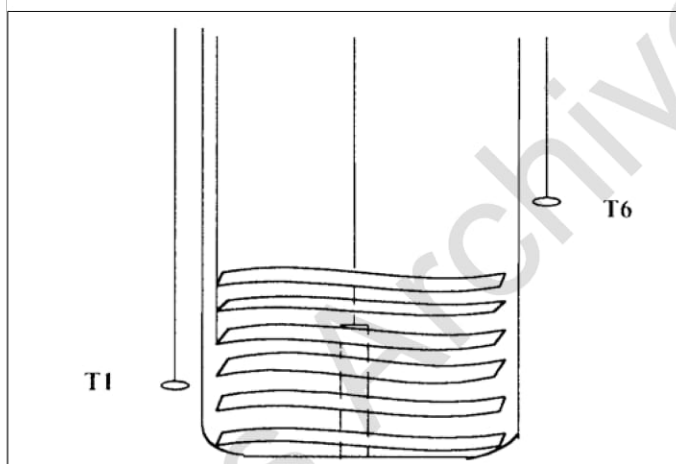


Figure 1. Schematic of positioning of Thermistor T₁ and T₆ relative to the palladium cathode rod and platinum anode coil.

perature reading for each thermistor channel was numerically displayed to within 0.01°C and printed as a dot on the chart recording every eighteen seconds. There were permanent chart recordings of all six temperatures (four cell temperatures, bath temperature, room temperature) as well as both cell voltages for the entire experiment. In addition, measurements were recorded in a notebook during working hours. The bath temperature was always maintained at 21.51±0.01°C, and the room temperature was generally 1 to 2°C higher than the bath temperature. These experiments were conducted in a thermostatted room at NHE specially designed for calorimetric studies.

Summary of Calorimetric Results at NHE

The summary of experiments conducted at NHE using the China Lake calorimetric cells is presented in Table 1.

Table 1. Summary of NHE Experiments Using China Lake Cells

STUDY	CELL A	CELL B
First	Pd Rod Constant Current $P_x = 100$ mW	Pd Rod Constant Current Control ($P_x = 0$)
Second	Pt Particles Constant Current Control ($P_x = 0$)	Pd Particles Constant Current $P_x = 90$ mW
Third	Pt Particles Pulse Electrolysis Control ($P_x = 0$)	Pd Particles Pulse Electrolysis $P_x = 250$ mW

This paper will focus on the first study using palladium rod cathodes (1 mm x 20 mm) from Johnson-Matthey. In previous experiments conducted at China Lake,⁴ the same palladium cathode used in Cell A (Table 1) produced approximately 200 mW of excess power, but the other palladium cathode used in Cell B produced no measurable excess power effects and serves as a control. Therefore, Table 1 presents excess power (P_x) in three out of three

experiments and no excess power in three controls. Details of these experiments are described elsewhere.⁵

The experiments conducted at NHE using the F/P (F/P) Dewar type cells are summarized in Table 2.

Table 2. Summary of NHE Experiments Using Fleischmann-Pons Cells

STUDY	CELL 1	CELL 2	CELL 3
A	Pd-Ce-B Rod $P_x = 0$	Pd-0.5B Rod $P_x = 250$ mW	Pd-Ce Rod $P_x = 200$ mW
B	Co-deposition Cu Rod $P_x = 150$ mW	Co-deposition Cu Rod $P_x = 400$ mW	Co-deposition Cu Rod $P_x = 400$ mW
C	Electromigration Thin Pd Wire $P_x = 0$	Electromigration Thin Pd Wire $P_x = 150$ mW	Electromigration Thin Pd Wire (?)

Significant excess power was produced using the Pd-B alloy (0.5 wt.% B) prepared by the Naval Research Laboratory. Previous experiments at China Lake using similar Pd-B alloy cathodes produced excess heat in seven out of eight experiments.⁴ A much more detailed and accurate analysis of the data from this Pd-B experiment shows an even larger excess power effect as well as positive feedback effects, "heat-after-death," and large excess power effects during cell boil-off studies.¹ It is both surprising and disturbing that the methods developed by NHE for the analysis of the Fleischmann-Pons experiments show no excess heat effects for this same experiment. This indicates serious errors in the NHE alternative method of modifying the F/P calorimetry.⁶ The major problem with the NHE method is that a single calibration involving incorrect procedures was used in determining the heat transfer coefficient for the cell.¹ I developed my own methods of data analysis for the F/P cells while at NHE. As I refined my methods for evaluating the calorimetric measurements, they approached more closely the methods outlined by Fleischmann and Pons in their Icarus Systems handbooks available at NHE.⁷

The use of the Pd-Ce alloy in F/P Cell 3 also produced an excess power effect (Table 2), but again the alternative method of analysis by NHE showed no excess power. This same Pd-Ce cathode also produced significant excess power in a previous experiment at China Lake.⁴ The Pd-Ce-B alloy in F/P Cell 1 showed no significant excess power effects (Table 2). Three experiments involving the co-deposition of Pd + D onto a copper rod produced large excess power effects. Preliminary results of these experiments have been published.⁸ Finally, short experiments involving electromigration produced excess power in one experiment and no excess power in a second experiment (Table 2). Due to an error in assembling Cell 3, the excess power, if any, could not be determined.⁵ In summary, excess power was produced in six out of eight valid experiments conducted in F/P cells at the NHE laboratory.⁵

The fact that the alternative NHE methods showed no excess heat for F/P cells illustrates the problem in transferring calorimetric methods from one laboratory to another. The second laboratory often fails to follow directions and makes changes that compromise the calorimetry. Similar problems were encountered in the attempt to transfer the China Lake calorimetry to the Naval Research Laboratory (NRL). Various changes made by NRL greatly increased the calorimetric error to ± 200 mW, hence excess heat was not observed.^{4,9} This failure to reproduce the China Lake experiments at NRL resulted in the termination of Navy funding for cold fusion in 1995. Similarly, the initial failure of NHE to reproduce the Fleischmann-Pons experiments⁶ contributed to the termination of the Japanese program in 1998.

Calorimetric Equations

The basic calorimetric equation that describes the heat conduction cells used in this study is

$$P_{EL} + P_x = a + K\Delta T + P_{gas} + P_{calor} \quad (1)$$

where $P_{EL} = [E(t) - \gamma E_H]I$ is the power input due to electrolysis and P_x is the excess power.^{2,4} The P_{gas} and P_{calor} terms are rather complex and have been described previously.^{2,4} In this study, Cells A and B were run under steady state conditions where $(P_{gas} + P_{calor}) \ll K\Delta T$ and with sufficient insulation above the cells to render the power loss out of the top of the cell (term a) insignificant. Therefore, our calorimetric equation greatly simplifies to

$$P_{EL} + P_x = K\Delta T \quad (2)$$

The time dependent equation for the cell constant for either Cell A or Cell B at any given cell current (I) was determined experimentally to be expressed by the equation

$$K(t) = K_0 - (I/0.300) (1.85 \times 10^{-4}) (t - t_0) \quad (3)$$

where K_0 is the cell constant at the time (t_0) expressed in hours when the cell was last refilled with D_2O . The change of the cell constant with time is due to the decreasing volume (V) of the electrolyte in an open cell.²

The change of the cell temperature with time can now be calculated from Equation (2) where $\Delta T = T_{cell} - T_{bath}$, thus $d\Delta T/dt = dT_{cell}/dt$. Therefore,

$$dT_{cell}/dt = K^{-1}(dP_{EL}/dt + dP_x/dt) - K^{-2}(P_{EL} + P_x)dK/dt \quad (4)$$

assuming 100% faradaic efficiency ($\gamma=1.00$). If there is no excess power ($P_x=0$) or if the excess power is constant ($dP_x/dt=0$) with $P_x \ll P_{EL}$, Equation (4) becomes

$$dT_{cell}/dt = K^{-1} dP_{EL}/dt - K^{-2} P_{EL} dK/dt. \quad (5)$$



Final meeting at NHE. Left side: first, Dr. Lipson; second, Dr. Tripodi; Right side: first, Dr. Miles; second, Dr. Asami.
Photo courtesy Melvin Miles

Equations (4) and (5) provide the framework for the discussion of palladium rod experiments using the China Lake calorimetry (Table 1).

Results and Discussion

The constant current electrolysis of the $D_2O + 0.1M LiOD$ solution in an open cell slowly increases the conductivity of the solution, resulting in a gradual decrease in the cell voltage.² Figure 2 presents an example of this behavior for the China Lake Cells A and B using the palladium rod cathodes (first study in Table 1).

This nearly linear decrease in the cell voltage with time normally produces a corresponding decrease in the cell temperature with time.² The onset of excess power (P_x) can often be recognized simply by the anomalous increase in the cell temperature despite the decreasing applied power. This raises the fundamental question: how is it possible for the cell temperature to increase when the applied power is decreasing?

Figure 3 presents an example of excess power in Cell A, which covers the same time period as the cell voltage displayed in Figure 2.

Figure 3 is produced directly from the chart recording of the thermistor temperatures, hence time is plotted on the y-axis (ordinate) that feeds out the chart paper at a fixed rate. Two different temperature scales are used in Figure 3 since Cell A was running more than $10^\circ C$ warmer than Cell B. It is interesting to note that the T_1 thermistor line for Cell A and the T_4 thermistor line for Cell B are merged together until about 600 hours. Both the T_1 and T_6 lines for Cell A then show a substantial increase in temperature that represents a 60 to 70 mW gain in the excess power. The cell voltages shown in Figure 2 show no departures from normal behavior. In fact, the dT/dt slopes calculated from Equation (5) are significantly more negative for Cell A than for Cell B. The increase in the temperature for Cell A shown in Figure 3 is an example of anomalous behavior due to the production of excess power. In contrast, Cell B continuously displays only normal behavior (Figure 3). The room temperature and the bath temperature are also displayed in Figure 3, but their temperature scale ranges from $20^\circ C$ to $25^\circ C$.

Figure 4 displays another anomalous temperature increase in Cell A along with a calibration based on increasing the cell current from 300.22 mA to 320.28 mA for a period of 2.33 hours.

Based on notebook data, the power increase of 0.165W produced a temperature increase of $3.29^\circ C$ in Cell A. Therefore, the anomalous rise of cell temperature of $1.6^\circ C$ above the expected baseline prior to this calibration indicates an increase in the excess power of about 80 mW. Temperature changes of $\pm 0.1^\circ C$ are readily detected by these China Lake calorimeters, hence power changes of ± 5 mW are measurable. Figure 4 shows that the same baseline is followed before and after the calibration by the thermistors in Cell B. In contrast, Cell A shows different baseline patterns with both positive and negative values of dT/dt . However, both thermistors in Cell A, as well as in Cell B, always show exactly the same temperature changes. The temperature differences between two thermistors in the

same cell is likely due to differences in their positioning relative to the cell wall.

Figure 5 displays the average voltages for Cells A and B during the same time period shown for the cell temperatures in Figure 4.

The effect of increasing the cell current is readily apparent by the change in the cell voltage. However, there is no unusual behavior for the voltage of Cell A that can account for the anomalous increase in the cell temperature. Based on Equation (5), the dT/dt slope should be significantly more negative for Cell A than for Cell B. The episode of positive dT/dt values for Cell A (Figure 4) requires the assumption of an excess power term as in Equations (2) and (4) along with a significant increase in the excess power ($dP_x/dt > 0$).

There were five other examples for excess power in Cell A during this study that gave anomalous increases in the cell tem-

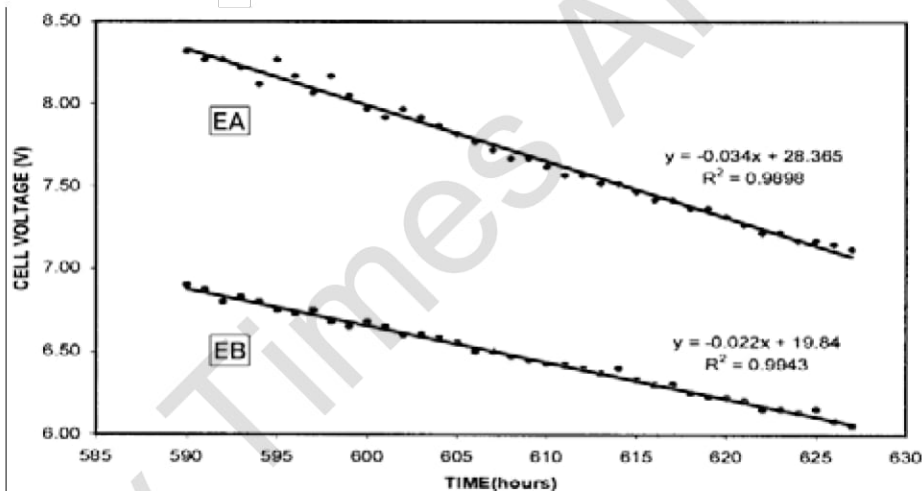


Figure 2. Average cell voltages for Cells A and B, showing the linear decrease in voltages.

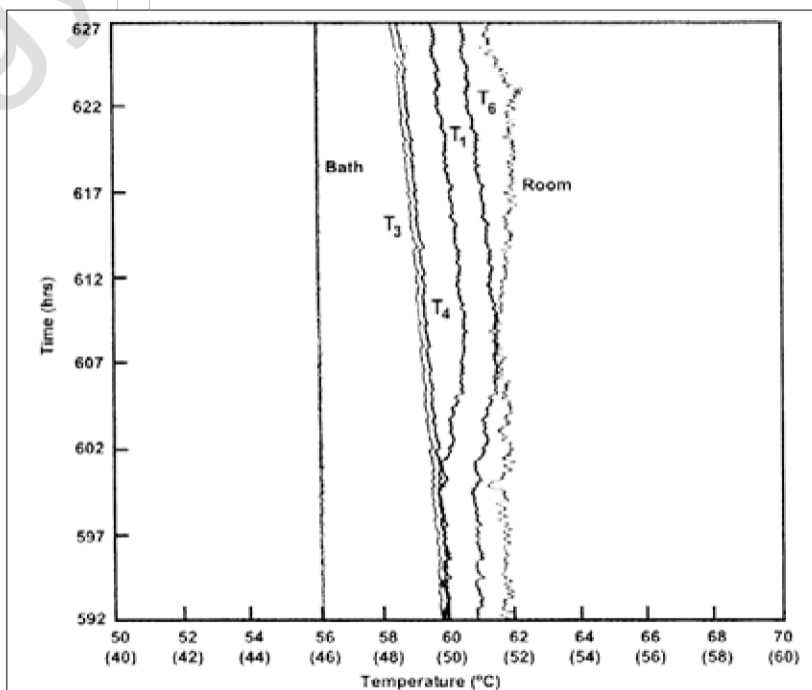


Figure 3. Temperature versus time for Cells A and B. Thermistors T_1 and T_6 show an anomalous temperature increase for Cell A beginning at about 600 hours. Bath and room temperature scales are 20 to $25^\circ C$.

Figure 4. Temperature versus time for Cells A. Thermistors T_1 and T_6 show an anomalous temperature increase for Cell A along with a calibration based on increasing the cell current. Bath and room temperature scales are 20 to 25°C.

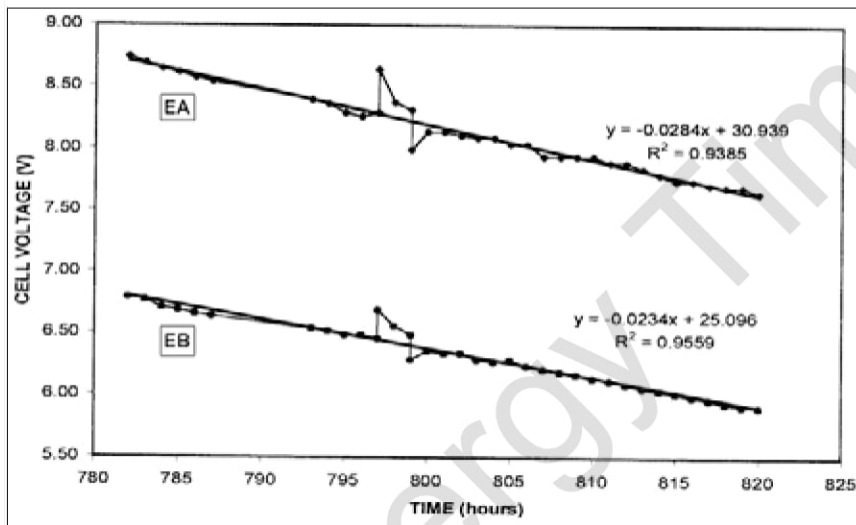
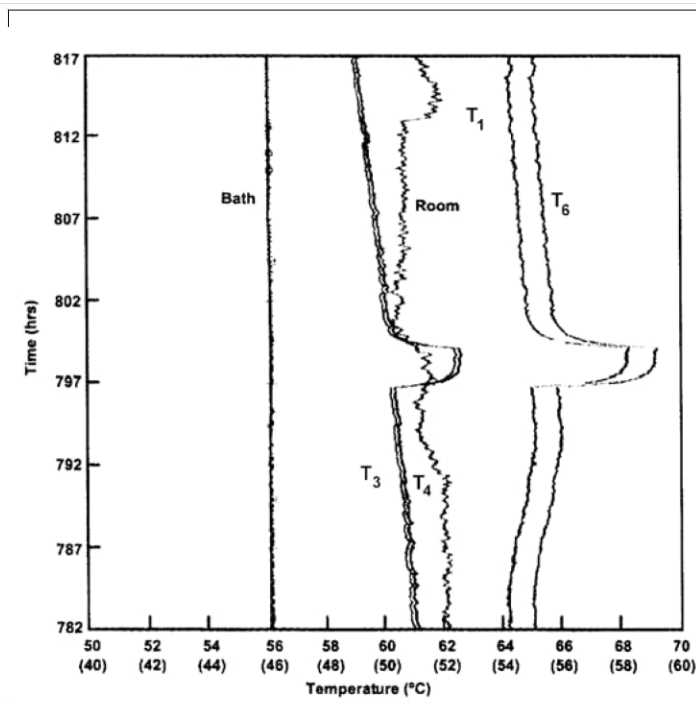


Figure 5. Average cell voltages for Cells A and B, showing the linear decrease in voltages along with a calibration based on increasing the cell current.

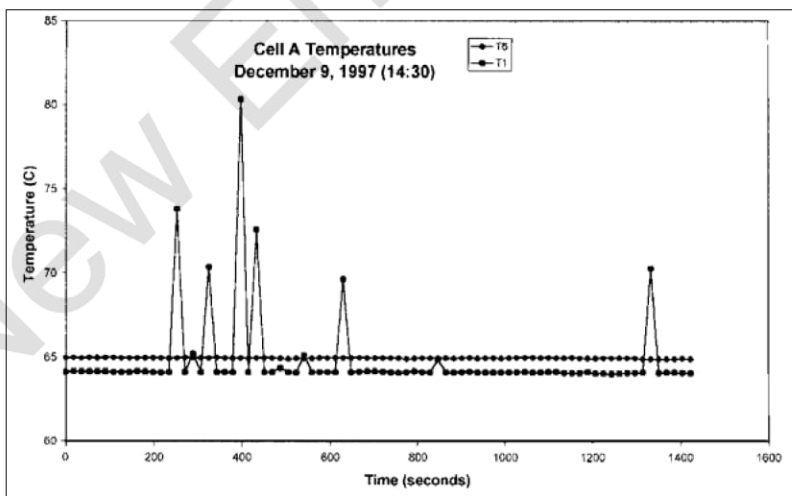


Figure 6. Thermistor readings versus time for Cell A (T_1 , T_6).

perature despite the decreasing electrolysis power.¹⁰ The calculated values of dT/dt using Equation (5) were always negative for both Cells A and B.¹⁰ Several possible chemical processes including recombination of the electrolysis gases were carefully considered but do not account for the anomalous increases in temperature for Cell A.¹⁰

During the same time period as the excess power production, strange fluctuations were often observed for the temperature readings for Cell A.⁵ Stray dots could be seen on the chart recordings for Thermistor 1 (T_1), while Thermistor 6 (T_6) showed normal readings. An example of these random jumps in the thermistor measurements is shown in Figure 6.

The thermistor connections were checked and tightened, but these thermistor fluctuations continued over a twenty-three day period that covered all episodes of excess heat in Cell A. This effect was never observed in any of the following experiments at NHE (Table 1). These thermistors were all identical and consisted of manganese, cobalt, and nickel sintered oxides that were glass coated and covered with a thin Teflon sleeve.

The temperature excursions (Figure 6) quickly returned to normal within the time period of separate measurements (eighteen seconds). This suggests that the sudden rise and decline in the temperature readings for Thermistor T_1 is due to electromagnetic radiation from the palladium cathode that affects the thermistor reading rather than actual increases in the temperature. As shown in Figure 1, Thermistor T_1 was located directly in line with the palladium cathode while Thermistor T_6 was positioned higher on the outside cell surface. It is readily seen from Figure 1 that any electromagnetic radiation from the cathode could pass directly between the platinum coils to reach Thermistor T_1 , while Thermistor T_6 was completely screened from the cathode by the platinum anode coils. Furthermore, the intensity of such radiation would be much less for Thermistor T_6 since its distance from the cathode was approximately four times that of Thermistor T_2 (4 cm vs. 1 cm). Later studies at China Lake have shown that gamma radiation sources such as cesium-137 can also produce anomalously high thermistor readings.

Acknowledgments

The author is grateful to the New Energy Development Organization (NEDO) of Japan and the New Hydrogen Energy Laboratory for the opportunity to do this research. The author especially thanks Dr. N. Asami for providing for this experience. The author also thanks Masao Sumi and Mari Hosoda for their help and assistance in these experiments along with Linda S. Miles and Kim A. Lincicum for

Miles continued on page 70

The Collapse of the NHE Project

Jed Rothwell

In 1994, Japan's Ministry of International Trade and Industry (MITI) instituted a research project in cold fusion, which they called "New Hydrogen Energy," or NHE.¹ An R&D laboratory was established in Sapporo, Hokkaido, where experiments were conducted for four years. Estimates of the total cost vary from \$23 to \$30 million.² When the program ended in August 1997, officials held a press conference and told the Japanese newspapers, Reuters, and *The New York Times* that none of the project goals had been met and no excess heat had been detected in any of the experiments. That was not true. Visiting scientists at the NHE, including Melvin Miles (China Lake Naval Air Warfare Center), did detect and report excess heat. Miles is one of the world's leading cold fusion researchers, and he has published extensive positive results previously.³

In this issue, we present an inside look at the NHE program, written by Melvin Miles (p. 18). This is a careful, balanced, detailed, and fair description, free of malice.

In his recent lecture at the American Chemical Society conference, Miles described his NHE results. I had heard nothing about them from my Japanese correspondents. I became suspicious, and I asked Akito Takahashi (Osaka University) to fax me the section of the NHE Final Report which mentioned Miles' work. (See Excerpts from the NHE Final Report, p. 29.) He and I translated it and sent it to Miles, who was shocked to learn that it did not mention his positive results. He felt that it is important that both his research paper and his personal impression of NHE be published, to counter this negation of his work.

The NHE managers disagreed with Miles. At ICCF-7 they mentioned his excess heat, but seemed unconvinced that it was real. Miles and I expected this would be their final conclusion. He submitted a detailed, formal paper to the NHE managers in which he claimed that eight out of ten cells produced significant excess heat.⁴ (There were also two control runs and one equipment failure.) The authors of the Final Report had a professional responsibility to describe Miles' own conclusions about his research—however briefly. They should have said they were skeptical about his conclusions, and they should have explained why. If a lab technician had disagreed with the NHE managers, omission might have been justified, but Miles was the scientist in charge of this set of experiments, and he was convinced the results are positive. It is highly improper to ignore such critical differences of opinion. This report is the formal summary of a \$30 million government research project, not an advertising campaign or a political platform.

In Japan, consensus is valued and it is considered unseemly to run roughshod over the minority. Japanese reports often reach inconclusive, mealy-mouthed conclusions to accommodate all points of view. This Final Report goes to the opposite extreme, squelching all debate.

When a government project ends in abject failure, it is not uncommon for the final report to put a brave face on defeat and to highlight any little progress that was made. This report does just the opposite: it covers up success! It makes a bad situation

look hopeless. The authors are not listed, but they would undoubtedly include Kazuaki Matsui and Naoto Asami (project and lab directors, respectively). I have discovered that they both support the Final Report conclusions. I find it unbelievable that they would willingly display themselves in such a poor light.

The final report is terse, lacking the level of detail appropriate to a formal document describing a multimillion dollar project. Whether these NHE managers honestly disagreed with Miles or not, we shall probably never know. They refuse to communicate. When the project began, Fleischmann was allowed to visit. He submitted three formal reports and repeatedly requested access to data, to no avail. Although officially listed as a formal adviser, he was frozen out by the NHE management—an appallingly cavalier manner in which to treat a distinguished Fellow of the Royal Society.

When a government project ends in abject failure, it is not uncommon for the final report to put a brave face on defeat and to highlight any little progress that was made. This report does just the opposite: it covers up success! It makes a bad situation look hopeless.

There is no way of knowing why the managers behaved the way they did. Did they actually disagree with Miles' conclusions? Were they covering up their own inability to replicate his results? Perhaps they were simply unable to understand his technique and analysis. One thing is certain: they consistently and deliberately ignored his

results. Miles says that when the cell he brought from China Lake began to produce excess heat, Asami politely refused to look at it. For weeks, the experiment sat there producing excess heat, yet Asami and the other managers did not bother to look at the instruments! It is astonishing that a person trained in a scientific discipline and charged with the responsibility of managing a multimillion dollar research program would act in this outlandish fashion. Perhaps Asami was so depressed by the imminent demise of the program, and four wasted years of his life, that he suffered paralysis of will. Or perhaps, as Miles suspects, Asami refused to look at the experiment because he felt he understood the calorimetry perfectly well, and Miles was obviously wrong, and it was not worth the bother. Whatever the reason, Asami's actions prove that he and the other managers never gave this experiment a fair chance. They never seriously analyzed it. They could have learned all about the experiment while it was underway, and Miles was available to explain it. I doubt very much they sat down after he left, read his thirty-two-page formal report, and earnestly debated the pros and cons of the calorimetry.

The U.S. DOE ERAB cold fusion panel members also refused to visit some laboratories or look at some experiments. The panel also shortchanged Melvin Miles. When the panel members visited him, he gave them his initial, negative results. Later, when he began to observe excess heat, he sent them a revised report. The ERAB report described his initial negative results only, ignoring the positive ones! This is appalling, but somehow it does not seem as bad as Asami's refusal to walk a few paces into a room to look at an experiment. The DOE panel was a farce. It was intended to reach a negative conclusion quickly, at minimum cost. Asami had a larger mandate. He was given millions of dollars and extensive facilities, and he began, at least, with a positive attitude.

When Miles invited Asami to look at the cell, Asami told him he should discuss the matter with Masao Sumi instead. Sumi's excuse for not looking made no sense: "[MITI] wanted large effects and would probably not be influenced by reports of small excess power although these would still be of scientific interest." It has been common knowledge from the start that cold fusion usually produces small effects. If MITI is not interested in small power gains, they should not have entered the field. Researchers must learn how to generate small effects first, and then find a way to amplify and scale them up. The NHE could not skip that step and graduate directly to 1,000 watt reactors! Every effect and useful phenomenon discovered in modern history has begun on a small scale. Airplanes began as kites and six-inch square metal airfoils in the Wright brothers' wind tunnel; the first fission reactor at the University of Chicago produced a half-watt of power (although it did weigh 864,000 pounds); transistors began with a small, handmade, impractical point-contact device that intermittently amplified a signal by 30%.

Some of the Problems at the NHE

When the NHE program finally collapsed, it came as a surprise to no one. We predicted this in 1996, because the NHE ignored recommendations made by experts, including recommendations in the leading Japanese journal of physics.^{7,8} The problems at the NHE turned out to be much worse than we realized. Late in the program, when the NHE began feeling desperate to see positive results, they invited Miles for six months, and Ed Storms for a brief visit. Michael McKubre of Stanford

Research Institute International (SRI) also spent some time there. After years of trying to do the job with engineers alone, someone decided that research scientists with Ph.D.s in materials science and electrochemistry might help. These outsiders agree on several criticisms, especially with regard to materials and the isoperibolic calorimetry which seems senselessly crude and inaccurate. It was based upon a *single calibration point*, taken *three or more days* into the run. It would be hard to come up with a less reliable method. Fleischmann knew about this methodology, because he analyzed the early NHE data published at the ICCF conferences, and he figured out what they were doing.

The project was burdened by a top-heavy, unresponsive management structure in charge of priorities, budgets, and research topics. It had a three-layer bureaucracy, steering committees, and an advisory board to manage a laboratory with a dozen people in it! Industry, academic, and government agencies contributed matching funds, vetted decisions, and developed a detailed plan before the project began. They did not consult with the leading cold fusion scientists, or with any leading electrochemists as far as the cold fusion scientists know. (Electrochemistry is a small world.) You cannot do groundbreaking research according to a schedule cast in concrete by a committee four years in advance. Research calls for flexibility and creativity. Asami understands this, which is why he let Miles and other staff members do what they felt was best. The problem was, the laboratory was staffed by engineers who had no experience in basic research. They did not *know* what was best, or where to start, because they were not Ph.D. electrochemists with experience in basic laboratory research.

"Type A" Palladium

For many years Martin Fleischmann has recommended a particular type of palladium made by Johnson-Matthey. He handed out several samples of this material to experienced researchers, and, as far as he knows, in nearly every test the samples produced excess heat. Fleischmann calls this material "Type A" palladium. It was developed decades ago for use in hydrogen diffusion tubes: filters that allow hydrogen to pass while holding back other gasses. It was designed to have great structural integrity under high loading. It lasts for years, withstanding cracking and deformation that would quickly destroy other alloys and allow other gasses to seep through the filters. This robustness happens to be the quality we most need for cold fusion. The main reason cold fusion is difficult to reproduce is because when bulk palladium loads with deuterium, it cracks, bends, distorts, and will not load above ~60% to ~70%. Below 85 to 90%, bulk palladium never produces excess heat. A sample of palladium chosen at random from most suppliers will *never* reach this level of loading. You could perform thousands of tests for cold fusion with ordinary palladium and never see measurable excess heat. That is essentially what the NHE did: they performed the wrong experiment hundreds of times in succession, using materials which cannot work. This is like trying to make a twenty-seven-story building out of doughnuts.

It seems likely to me that most of the reproducibility problems with bulk palladium cold fusion would have been solved years ago if people had listened to Martin Fleischmann's advice. Unfortunately, people seldom listen to advice or follow directions. Fleischmann sometimes compounds the problem by speaking in a cryptic, convoluted style and by using complex mathematical equations that few other people can understand. He sometimes takes a long time to respond to inquiries; he answered one of my questions two years after I asked. However, in this case he has made himself quite clear on many occasions. For example, he wrote:

... We note that whereas "blank experiments" are always entirely normal it is frequently impossible to find *any* measurement cycle for the PdD₂O system which shows such normal behaviour. Of course, in the absence of adequate "blank experiments" such abnormalities have been attributed to malfunctions of the calorimetry. However, the correct functioning of "blank experiments" shows that the abnormalities must be due to fluctuating sources of excess enthalpy. The statements made in this paragraph are naturally subject to the

restriction that a "satisfactory electrode material" be used, *i.e.* a material intrinsically capable of producing excess enthalpy generation and which maintains its structural integrity throughout the experiment. Most of our own investigations have been carried out with a material which we have described as Johnson-Matthey Material Type A. This material is prepared by melting under a blanket gas of cracked ammonia (or else its synthetic equivalent) the concentrations of five key classes of impurities being controlled. Electrodes are then produced by a succession of steps of square rolling, round rolling, and, finally, drawing with appropriate annealing steps in the production cycle. [Fleischmann, M. *Proc. ICCF-7*, 121.]

Fleischmann recently gave me some additional information. The ammonia atmosphere leaves hydrogen in the palladium, which controls recrystallization. Unfortunately, this material is very difficult to acquire and there is practically none left in the world, because Johnson-Matthey stopped making it several years ago. Palladium for diffusion tubes is now made using a different process in which the palladium is melted under argon. Material made with the newer technique might also work satisfactorily in cold fusion experiments, but Fleischmann never had an opportunity to test it so he does not know. I asked him how confident he is that this material is effective, and how much batch-to-batch variability he observed. He said that since 1980 he has used samples from eight or nine batches. Only one batch failed to work, and was returned for credit.

In their Final Report, the NHE claimed that they used "the type of palladium recommended by Fleischmann and Pons" in a series of experiments in the final stage of the project, after all else had failed. They did not have any of the Type A left. Perhaps they used some other Johnson-Matthey material instead. They have refused to tell Fleischmann the batch number or say when or where they acquired the material, but as far as he knows, there was no Type A material available at that time.

I once asked Fleischmann how he learned about Type A palladium. He said: "It is very simple. When we began this research, I went to Johnson-Matthey, told them what I needed, and they recommended this material." Fleischmann has a baroque imagination and he often goes about doing things in indirect, recondite ways, but in this case he used the direct approach.

Tadahiko Mizuno (Hokkaido University) said the NHE staff thinking was unoriginal. Miles said "the engineers did excellent work in duplicating other people's experiments but did not come up with many new ideas." An unfair comment, perhaps. In engineering, originality is not valued as highly as knowledge, competence, and teamwork. The finest engineers are essentially cautious, thorough perfectionists. They are supposed to stick close to the building codes and the textbooks. They look up the answer when they can, rather than working things out from first principles. They take no unnecessary chances; people's lives depend upon the machines they build. Engineers are not the right people to do groundbreaking new science. By the same token, you would never assign a group of research scientists to build a practical machine! Engineering, laboratory research, and theoretical science draw upon the same knowledge base, but they require different skills. Miles feels that if cold fusion had been closer to technological fruition, this would have been an ideal group to work on it, but in 1995 it made no sense to staff a cold fusion project with engineers. MITI is supposedly a pragmatic, experienced organization, yet somebody in authority there does not understand the difference between industry and academic science. McKubre summarized the problem: "The purpose of the NHE project was to give Japan a competitive advantage in the development of cold fusion *technology*. Not to research a phenomenon to practicality."

This desire for competitive advantages explains why the NHE was a closed club. It was an industrial consortium: the sort of thing you form to make a better computer chip or some other incremental improvement to existing technology. The information gleaned from the experiments was supposed to be made available exclusively to corporations and huge national agencies that paid millions to participate. Research in basic science cannot be done on this basis. Results must be published in journals and made freely available to everyone.

A good engineer must have initiative, and this is one quality the NHE staff lacked. They built fine instruments and they reproduced some experiments diligently, but they did not take steps on their own initiative to learn more about the field and make sure they were doing things right. They did not read the literature, and they often missed the point. Engineers tend to respect authority and reach for the textbook, but unfortunately there are no textbooks in cold fusion. There are no blueprints to follow and no authorities, except Fleischmann, whom they made a point of shutting out. There is excellent advice scattered through the literature in papers by Storms, Cravens, Fleischmann, and others. Unfortunately, the NHE engineers did not know about it. They blindly repeated bulk-palladium experiments more than 100 times, without checking the most important parameters, such as whether cathodes were expanding too much (excess volume), loading unevenly, clotting at the surface with galvanized contamination, and without measuring the open circuit voltage (OCV). They finally began doing these things in the last year of the program, after Storms visited and acquainted them with the techniques, but by that time it was too late.

As a practical matter, I do not think the NHE engineers could have read much of the English literature. Miles says that Mari Hosoda, a female laboratory technician, "spoke English reasonably well" and was able to answer most of his questions. I take that to mean the others in the laboratory did not speak English

well enough to carry out ordinary, day-to-day research activities, so they would have found it tedious and unrewarding to read English papers. They would have found Fleischmann's abstruse instruction handbook particularly tough.

The engineers sometimes became so focused on accuracy and the job at hand, they lost track of the larger purpose.

When Storms visited the NHE, he discussed the excess volume problem. A cathode made of weak material will swell up too much when it loads. He demonstrated his technique for measuring the volume of a cathode before and after electrolysis. He measures the thickness of a palladium foil at six points with a handheld micrometer and extrapolates the total volume. There are more accurate ways of measuring volume. The most well-known and fundamental is Archimedes' method: you submerge the object in water and see how much fluid is displaced. But, as Storms explained, this does not work with a cathode. You must measure the volume when the cathode is in the beta phase (~70% loaded, with seven deuterons for every ten palladium atoms). In this state, the cathode acts like a balloon with a hole in it. The gas rapidly escapes, or

"outgasses," and the swelling goes down, so you must measure the volume quickly before gas escapes. When you put the sample in the test tube of water, bubbles from the escaping gas cause the water level to slosh up and down, and you cannot get an accurate reading. When the cathode reaches the

alpha phase (~30% loaded) it is no longer under much pressure and outgassing slows down. The swelling also goes down. The cathode is stable and quiet, but it tells you nothing about excess volume.

Months after he returned home, Storms talked with the NHE engineers again. They said they were now measuring excess volume per his recommendation, but they were not satisfied with the accuracy of the handheld micrometer. They decided to use Archimedes' method, but they were having troubles with bubbles. So they decided to test only alpha phase samples. They forgot that this defeats the purpose!

Storms later acquired samples of NHE palladium and tested excess volume himself. He found that some of it expands 20 to 30%. Anything above 2% will prevent the cold fusion reaction. Storms also described a case in which the researchers did not have the right background to interpret the data. When contamination from the electrolyte is galvanized onto the cathode surface, it can block the surface and prevent loading. This is a common problem. Storms asked the NHE researchers if they had experienced it. They assured him their cathode surfaces were clean. He asked for proof, and they brought out a six-inch thick binder filled with analytical reports, SEM (scanning electron microscope) and XPS (X-ray photoelectron spectroscopy) studies of the cathode surfaces. Storms saw that the XPS data showed a thick layer of silicon on the surface, more than enough to prevent loading. He recommended steps to reduce contamination. The engineers quickly learned to interpret the data correctly, and they took the steps he recommended, but it was too late in the program to have an impact.

On top of the technical difficulties, the language gap, and the knowledge gap, there was a morale problem in the lab. Some of the NHE researchers were unwillingly shanghaied from their regular jobs and exiled to Hokkaido, far from their families and friends for six months, or for years. They were ordered to research cold fusion, although they had no particular interest in it. Some of them openly stated that they wanted to get the job over with quickly, publish a negative result, and go home.

You cannot do groundbreaking research according to a schedule cast in concrete by a committee four years in advance. Research calls for flexibility and creativity.

Other people working on the project were sincerely interested and hoped for positive results. They were deeply discouraged by the negativists. Mizuno's lab is close to the NHE. The unhappy people who sincerely wanted to do cold fusion would slip out of the NHE, visit Mizuno, and complain. They told him they wished they could quit the NHE, move into Hokkaido University, and work with him instead. They said that when they saw signs of excess heat, the managers would dismiss it as experimental error. They told him, "No matter how positive the data might be, the NHE will never let us publish it."

Soon after the program got underway, Mizuno and most other Japanese cold fusion scientists were frozen out. Miles wondered why Mizuno never came to visit him. It turns out Mizuno never knew Miles was there, because no one at the NHE told him. Mizuno feels the NHE managers did not want professional electrochemists, academics, and other "free agents" coming around because they were "too critical." They poked around, made suggestions, and embarrassed people. When a project runs into trouble, people sometimes become defensive, which only makes matters worse.

Complaints About the NHE by Outsiders

After Melvin Miles sent us this detailed report, I decided to circulate the section of the NHE Final Report dealing with his work to other scientists who had participated in the project for comments. I sent copies of the translation and the Miles abstract to Fleischmann, McKubre, Storms, Takahashi, and Mizuno. I was surprised at the vehemence of their responses. They fell into two camps: angry and sympathetic.

Fleischmann, who seldom communicates unnecessarily, responded with a twelve-page, blistering fax. He told me much the same story two years ago when we met. He is still quite,

understandably, upset by the way they treated him. Takahashi and Mizuno discussed the NHE report during a conference on January 20, and Mizuno sent me an angry, two-page e-mail, condemning the NHE and Japanese science in general.

Miles, McKubre, and Storms are more moderate. They sympathize, but they do not excuse the mistakes. McKubre was kind enough to answer several questions about the NHE calorimetry. Storms discussed the NHE problems with materials last year and has little to add at this time. Miles did a splendid job of presenting the sympathetic view, so I will devote the rest of this article to the more outspoken views of Fleischmann and Mizuno. I myself view the NHE with a mixture of anger, consternation, and sympathy for people who challenged the unknown and found themselves facing a far more difficult task than anyone on earth could have predicted.

Fleischmann began his association with the NHE by providing them with a 500-page instruction handbook covering every aspect of the isoperibolic calorimetry that he and Stanley Pons devised at the IMRA lab in France.⁹ Some people have criticized this calorimetry because it relies upon complex equations. There are alternatives. A slightly more elaborate cell with an external envelope for the temperature probes is easier to model and easier for most researchers to deal with. First-principle flow calorimetry is easier to understand, and it yields more readily identifiable and quantifiable results, although Miles and others say it can prevent positive feedback. Calvet calorimetry is reportedly accurate and relatively easy. The difficulties experienced by the NHE researchers show that it takes a skilled person to operate the Fleischmann-Pons calorimeter. However, people who criticize the complexity miss the point. Fleischmann and Pons designed this cell for a specific purpose. They ran sixty-four cells at one time, monitoring them with a single, small computer. This allowed

Excerpts from the NHE Final Report

The NHE project was under the auspices of an MITI subsidiary agency, the New Energy Development Organization (NEDO). Here is one section of the NHE Final Report, titled *Shinsuiso enerugii jissyou gijyutsu kaihatsu* (New Hydrogen Energy Verification, Engineering and Development), NEDO-NHE-9701 (June, 1998), p. 120. The authors of this report are not listed. This translation is by Akito Takahashi and Jed Rothwell, with footnotes and commentary by Jed Rothwell.

Section 3.5

Open cell electrolysis excess heat verification experiments
3.5.1 Summary

Starting in 1995 we began a series of tests with an ICARUS-2 open cell electrolysis system acquired from Fleischmann and Pons, however we were unable to replicate excess heat with this system. It had been anticipated that when the ICARUS-1, which only functions up to 70°C, was upgraded to an ICARUS-2, which allows operation at higher temperatures in the boiling regime, the high temperatures would promote excess heat generation. Moreover, since we did not observe excess heat with the palladium supplied by them, we tried the palladium that was used to produce excess heat in the I/J [Imra Japan] cell, which may be considered a standard, but it too failed to produce excess heat.

Dr. Miles came to the NHE as a guest researcher from United States, bringing cathodes which reportedly generated excess heat in previous experiments. He installed the cathodes in the ICARUS-2 calorimeter. Both his results and the NHE ICARUS-2 tests are described below.

3.5.2 Experimental results

The external conditions and results are shown in table 3.51 [not reproduced here].

1) F/P experiment

After the project began, we reached a stage at which over 100 runs were conducted without replicating excess heat. We decided to start from scratch and perform experiments with Johnson-Matthey palladium.

Three experimental runs were performed, but in all three cases,

as in previous tests, excess heat was not replicated. Sample results are shown in Figures 3.51, and 3.52 [not reproduced here]. After maintaining a 200 mA current for a period of one week, current was increased 250 mA for approximately one month, and then the experiment terminated with a boil-off event. Calibration performed with a heater proved to be highly replicable, however when current was increased 250 mA, the excess heat computations showed a shift to the negative side. Based on past experience, we believe this was caused by heat losses from the power leads going into the cell. In the analysis of the boil-off event, when we took into account evaporative losses, a peak value seems to indicate excess heat, but this was only caused by an overflow, [See Translator's Note 1.] and the actual signal fluctuated around the zero line. However, after amperage was increased to 500 mA the cell rapidly reached the boiling point, in comparatively much less time than the previous low-power stage of the experiment. Results indicate that during the long, low-power electrolysis phase impurities accumulated on the cathode surface. Furthermore, in experiment 7121, the condenser came in contact with the collection cell used to weigh the condensate, which caused large instabilities.

3) Miles' experiment

Our guest researcher, Dr. Miles, performed an experiment in the NHE laboratory using an ICARUS-2 calorimeter [supplied by Fleischmann and Pons]. He installed a cathode which he claims previously generated excess heat.

Experimental results are shown in Figures 3.5.9 through 3.5.12 [not reproduced here]. [See Translator's Note 2.] Miles altered the input current patterns to fit his own ideas about how the experiment should be done, in a complete departure from the protocols which were recommended by Fleischmann and Pons, and which were used in all previous experiments performed by NHE personnel. He has added heavy water by observing the water level of the cell, while the NHE team added heavy water constantly and automatically. [See Translator's Note 3.] Calculated excess heat fluctu-

them to test many variations of the experiment simultaneously, and many types of material. This Edisonian approach is an excellent idea. You could not do it with a bank of sixty-four flow calorimeters or Calvet calorimeters. That would be a nightmare of complexity. The equipment alone would cost more than a million dollars. Given the poor reliability of these systems, on most days several of the machines would be broken.

The NHE could only run three of these cells, not sixty-four, so they had no need for enhanced reliability and simplicity. (Miles reports that they had at least six extra glass cells in storage, but they could only run three cells at a time in the water bath.) They might have done better with a more elaborate, expensive isoperibolic cell with external temperature probes, like the one Miles designed and brought with him to Japan. This is easier to model. Fleischmann told me that if he was making one or two cells for

ated between positive and negative values, and the overall data set does not constitute clear evidence of excess heat. In the last phase of experiment M7c2, boiling was induced by raising the current to 1A. In the boiling phase, no clear sign of excess heat was observed; the heat profile was the same as we saw in previous boil-off tests. Midway through the boil-off test, large temperature fluctuations occurred, perhaps because the condensation tube came in contact with the condensate collection vessel. [See Translator's Note 4.]

3.5.3 Conclusions

We performed 100 runs which should have replicated the open cell electrolysis method published by F&P. Finally, as a last step, we performed experiments using the Johnson-Matthey palladium supplied by F&P, [See Translator's Note 5.] and based on the comments they made to us, we conducted long-term experiments in which electrolysis continued for a half-year, [See Translator's Note 6.] as well as experiments using cathode materials which previously produce excess heat.

In both of these tests, as in all previous experiments, excess heat was not observed.

Translator's Notes

1) The English word "overflow" is used here. Based on the NHE claims made during ICCF conferences and in an interview published in the *Nihon Keizai Shimbun*, I surmise this means entrainment; that is, unboiled fluid leaving the cell in droplets or froth. Fleischmann addressed this issue years ago in his lectures and letters, pointing out that "we recover ~95% of the alkali by dissolving the residues and titrating; some is undoubtedly lost by irreversible reactions with the glass walls of the Dewars." [Letters to Steve Jones] In other words, he proved that significant amounts of electrolyte do not leave the cell, because if it did, it would carry off the reagent and virtually all of the reagent is found in the cell after a boil-off test.

2) These graphs bear no resemblance to the graphs shown by Miles at the American Chemical Society or in his ASTI paper. As discussed above, Miles is convinced the cells did produce heat, but the authors of this report apparently disagree.

3) Fleischmann says that based on an analysis of the calorimetric data, he discovered that NHE staff members always overestimated heavy water consumption and overfilled the cell with their automatic refilling machine, which I gather works something like an intravenous pump. When refilling a cell with any method you must keep track of the actual waterline. McKubre comments:

... I had never focused before on the top-up pump used at NHE. We have used these extensively. For one reason or other, they always go wrong, either over- or under-watering the cells. We never got any satisfactory results in this mode of operation. If ALL of the NHE F/P experiments were performed in this way, and NONE of Stan and Martin's were, and a contaminant leached from the pump poisoned the cathode. ... [Private communication, January 2000.]

4) The Japanese text says only, "the condenser came in contact." It does not say what it came in contact with. In the paragraph above describing experiment No. 7121, they state explicitly that the condenser came in contact with the condensate collection vessel. I assume they experienced the same problem again when testing Miles' cathode.

5) Fleischmann says this is not so. He gave them only three samples, which were used in early tests, published in ICCF-5.

6) Running a cold fusion experiment for six months without results

demonstration kits, he would use a similar design, with a copper sleeve around the cell, temperature probes embedded in the copper, and a thin outside sleeve. (If the outside sleeve was too well-insulated most of the heat would escape from the lid.)

Miles said the 500-page handbook included complex full page physics equations, and it was so difficult it would have taken him six months to master it. He used his own equations developed earlier at China Lake. He did not follow the manual's instructions to the letter—for which the NHE Final Report criticizes him. However, he did study the manual, and the more he learned, the more his respect for Fleischmann grew. His own equations are based upon a similar model, but in a considerably simplified form. The NHE criticism of this technique is hard to justify when none of their adopted techniques were based upon those of Fleischmann. They were, I believe, merely engineering

is a preposterous thing to do. I very much doubt that Fleischmann and Pons recommended this course of action.

Commentary

The conclusions reached in this report are exactly the opposite of those Miles described in his report on the NHE and in his ACS and ASTI presentations. Miles thinks the NHE data evaluation method is not based upon Fleischmann and Pons:

The fact that the alternative NHE methods showed no excess heat for F/P cells illustrates the problem in transferring calorimetric methods from one laboratory to another. The second laboratory often fails to follow directions and makes changes that compromise the calorimetry. [Miles, M.H. "Report on Calorimetric Studies at the NHE Laboratory in Sapporo, Japan," ASTI proceedings].

The NHE says their calorimetry is based upon Fleischmann and Pons' method described in the handbook. This report accuses Miles of departing from that established standard in his tests with the Fleischmann-Pons cell. (His own cell, which he brought from China Lake, works by conduction rather than radiation across a vacuum gap, so the model and equations would need to be different.) Experts who have examined the NHE methods think that their method is a departure from the Handbook and indeed from all other physics-based models, for two main reasons:

- 1) They employ only one calibration pulse, which is performed three days into the run. This method is unheard of, outside the NHE.
- 2) They assume there is no excess heat during this single pulse, even though other methods based on absolute standards sometimes show excess heat is already occurring when this pulse is made. In other words, they define the starting point, or the zero-point, by fiat.

Fleischmann examined the single calibration pulse published by the NHE at the ICCF conferences. [Fleischmann, M. "Cold Fusion: Past, Present, and Future," *Proc. ICCF-7*, p. 119.] He says it proves the cell was already producing excess heat when this supposedly zero-point setting was established. He bases this on first principle, absolute methods of analysis:

- 1) After a heat pulse, the heat decay curve does not fit Newton's law of cooling. The cell does not cool fast enough; there must have been an extra, unaccounted for source of energy stretching out the curve.
- 2) The cell temperature does not "relax" all the way back to the original base temperature where it started before the pulse, because cold fusion positive feedback was already occurring.

He published papers about this and informed the NHE, but they ignored him.

McKubre described the arbitrary zero-point setting:

The Japanese retroanalysis method. . . processes all the data retrospectively, and assigns the mean as zero (*i.e.* net excess energy = 0). Variations, even known systematic variations, are considered as uncertainty (or "error"). Nothing counts unless it is more than three times this uncertainty value. This is what physicists do in stochastic system analysis, and chemical engineers when they have no knowledge of experiment details and no absolute calibration. For our experiments and F/P experiments (whether performed by Mel Miles or not) it is just WRONG!!! [Private communication, January 2000.]

"Known systematic variations" would be, for example, complications introduced by changing water levels in the cell. This could be accounted for by making the formulas more complex and adding a term for the water level. The NHE workers chose to keep the equations simple and fold all minor sources of noise into one large estimate of uncertainty.

approximations (see Excerpts from the NHE Final Report, p. 29), and I suspect the handbook remained permanently unopened.

In his fax to me, Fleischmann listed his complaints about the NHE and about his former employer IMRA, which worked closely with the NHE:

For several years, Fleischmann repeatedly requested detailed information about the experiments performed at the NHE. He asked for copies of raw data. The NHE ignored his requests. He used data they published at ICCF conferences instead.

He asked for data from "blank" runs (control runs with platinum or non-working palladium). They did not respond, and they have not published any blank run data at ICCF conferences, so we do not know whether control runs were ever carried out. Miles says that to his knowledge, no blank runs were performed with Fleischmann-Pons cells at the NHE. This is astounding. I have never heard of anyone doing these experiments without control runs.

The NHE claims that they used Johnson-Matthey Type A palladium in their final round of tests. Fleischmann disputes this, because he only gave them three samples of Type A, and he knows they used these in the initial stages of the project. Two of these samples produced excess heat and one failed for prosaic reasons. As far as Fleischmann knows, Johnson-Matthey stopped making this type of palladium many years ago and gave him all of the remaining stocks. [See "Type A" Palladium, p. 27.]

In his instruction handbook for the NHE, Fleischmann said there are some thirty ways to analyze the calorimetric data. Twenty-nine of these variations produce reasonably accurate results in a close range of values. One is "highly error prone" and usually incorrect. The NHE later refused to tell him which method they selected, but based on his retroactive analysis of the data they published at ICCF conferences he concludes they selected the one unreliable method which he warned them against.

The NHE claims that the calorimetry is error prone and enthalpy fluctuates around the zero line. However, for the margin of uncertainty to be as large as they claim, Fleischmann says, "one would need an error in the cell temperature of 5 to 6°C." This is ridiculous; no thermocouples are that inaccurate. It is particularly ridiculous because two thermocouples were used, and they agreed to within a fraction of a degree.

After Fleischmann returned to England from France, his files and personal papers from the laboratory were shipped to his house. Someone from the NHE or IMRA France removed many of his personal documents and critical data showing excess heat. They have refused to return these documents despite many requests over the years.

At ICCF-5, the NHE showed data from two experiments. The first was subject to a fault which could not be identified (probably a bad connection). The second was corrupted by excessive noise. These facts were spelled out to the NHE by Fleischmann in two formal reports. He showed that in the second experiment, despite the noise, excess heat was measured.

I sent this list of objections to the project managers, Matsui and Asami, along with the translation of the Final Report and the abstract of the Miles paper. They did not respond to me. However, they asked Elliot Kennel (a U.S. nuclear engineer who worked at the NHE for one year) to reassure Melvin Miles of their good intentions. Kennel wrote to Miles:

According to the information I've been sent from Matsui-san and Asami-san, it seems that Jed will probably allege that there was unethical behavior at the lab and suppression of data, including your experiments.

Matsui-san and Asami-san have indicated to me that they

don't care what Jed writes, but they do care about your opinion. Miles refused to be mollified, responding curtly:

Jed Rothwell has informed me that the Japanese version of the final NHE report does not credit me with any excess heat effects in my experiments. Naturally, this has upset me. Once again it appears that politics are trying to erase scientific truths relating to cold fusion. This I cannot and will not support.

Matsui and Asami told Takahashi that they will reevaluate the Final Report in February to see whether it fairly represents Miles' viewpoint. They might revise it, but that would hardly matter now. To undo the damage, they would have to formally retract their claims in letters to the scientific journals and hold a formal press conference to inform the Japanese newspapers and *The New York Times* that their previous announcement was in error. I do not think they plan anything so dramatic!

The Big Mistake Hypothesis

Was the NHE project a conspiracy to make cold fusion look bad or to turn it into a "black project" in nuclear weapons research? Was it intended to fail from the very beginning? I do not believe in conspiracy theories and I would not entertain such a lurid question normally, but Martin Fleischmann thinks the program may have been a set-up. He believes that the military and government agencies like the CIA are afraid that cold fusion may have weapons applications, and they are actively campaigning to suppress it. I doubt this, because I have little respect for the acumen of the CIA and other intelligence agencies. After all, the former CIA head (now MIT professor) John Deutch knew all about cold fusion in the early days but has been pompously ignoring it ever since. It is only barely plausible that lower echelon CIA operatives cared about cold fusion enough to suppress it, while the Director, an MIT chemist, ignored it.¹⁰ We do not know whether cold fusion has nuclear weapons applications, but if it does I do not think the CIA would be smart enough to realize it. I respect Fleischmann. I do not think he is paranoid or blinded by his bitter experiences. He has many years of experience in industrial research. He was close to the NHE project and he conferred with the leaders before they froze him out, so he is in a much better position to judge what happened than I am. There is no doubt the program had powerful enemies, but my gut feeling is that Miles is correct; the program failed mainly because the problems are difficult, and engineers are not the right people to solve them.

Why would the enemies within the Japanese government bother to spend \$30 million to kill cold fusion, when it was already dead? Long before the NHE project got underway, cold fusion was discredited in the eyes of the Japanese public. There was no funding available, and cold fusion scientists were shut out of the major scientific publications, ridiculed at conferences, and ostracized from universities and corporations. Cold fusion has never been a threat to its most prominent enemies like Akito Arima (retired president of Tokyo University) or John Huizenga (DOE ERAB panel). If anything, they have benefitted by periodically attacking it and making a name for themselves in the newspapers.

Perhaps Fleischmann underestimates the power of stupidity, and its role as one of the great driving forces of history. Barbara Tuchman gave numerous examples in her masterpiece *The March of Folly* (Alfred A. Knopf, 1984). When I think of the mistakes, the waste, and the heartbreaking lost opportunities of history, I do not find it difficult to imagine that the NHE project was bungled. MITI has made colossal mistakes, much more expensive than this. Shortly before the NHE began, MITI's Fifth-Generation

Computer Project ended without achieving any major goal. Their breeder reactor program is one of the most expensive fiascos in the history of energy. If everything had worked according to plan, plutonium breeder reactor electricity would be five to fifteen times more expensive than electricity from conventional sources. In 1992, after spending \$5 billion on the Monju reactor, a senior government official said, "It is almost inconceivable that such a good idea could have turned this bad. We spent the last twenty years building this project, and will probably spend the next twenty killing it."¹¹ Monju was closed and put on "standby" in 1995 after three to five tons of sodium leaked out, came in contact with water, and burst into flames.¹² It will not be reopened until 2003 at the earliest.¹³ In 1999, fuel preparation for the Joyo Fast Breeder reactor resulted in Japan's worst nuclear accident, at Tokaimura, which killed one worker and severely injured another. This led to the first major public protests against nuclear energy in decades and the delay of two power reactor projects.¹⁴ The breeder reactor program is endangering the fission power industry in Japan more effectively than a conspiracy or a propaganda campaign ever could.

The NHE program began with good intentions and high hopes. Mizuno says that when it started, many scientists came out of the woodwork and applied for grants, including some "vaunted experts" who had earlier criticized cold fusion or made vague, noncommittal statements about it. Mizuno says these people are "always ready to jump on the bandwagon," but at the same time they are "careful to leave a clear path of retreat in case things go sour." They change their opinions as quickly as a weathercock changes direction, they take no responsibility, and they say one thing in public and another in private. When EPRI announced it would fund cold fusion research, Tom Passell of EPRI saw similar behavior. Scientists who were publicly excoriating the field, privately came to him asking him for grants to study it. Mizuno says the NHE was supervised by MITI and by a panel of "so-called outside experts," which means, in practice, people who have not performed cold fusion experiments or published papers. It means the people in charge of the program were nuclear physicists and others with no qualifications and no clear idea what needed to be done. This works about as well as putting a group of electrochemists in charge of a tokamak project, or putting the Boston Red Sox baseball team in charge of the Metropolitan Opera.

Mizuno suspects that Arima had a high-level advisory role in the NHE. He is a very influential scientist, and he despises cold fusion. He would have tried to kill the program, and failing that, he would have tried to limit the budget and prevent first-rate people and resources from being assigned to it. Y. Takahashi of Tokyo University was probably a high level advisor to the NHE, and Hideo Ikegami from the National Institute of Fusion Science (NIFS), Japan's tokamak hot fusion research center, was listed as one. These two "used to be" cold fusion researchers, as Mizuno put it. Sometime or other they stopped doing research and carefully distanced themselves from it. Ikegami measured excess heat with isoperibolic cells, and he faxed copies of the data to me and to several other people, but he never published this or any other data. I asked him why he held back. He said, "We only publish world-class research. Anyone can think of a dozen reasons why this kind of the cell would produce artifactual heat." But he did not offer any reasons then, or at any other time, as far as I know. When the NHE program collapsed, Ikegami told *The New York Times*, "We couldn't achieve what was first claimed in terms of cold fusion. We can't find any reason to propose more money for the coming year or for the future."¹⁵ It is difficult to know what to make of this statement. Who did he mean by "we"? The NHE engineers? Melvin Miles? Ikegami himself? If

he meant that the NHE engineers failed, most people would agree. But if he meant that every experiment at the NHE lab failed, including Miles', and that all money for research in Japan should be cut off, then I think he is one of those irresponsible elite scientists who change direction like weathercocks and keep a clear path of retreat ready. We do not know what Ikegami meant. People have asked him repeatedly, but he does not respond. I suppose a mainstream scientist would say Ikegami was making an honest reappraisal of his previous support for cold fusion and a brave admission that he had been wrong.

Political dirty tricks and media pressure was brought against the NHE project soon after it began. After ICCF-3, Japanese National Television (NHK) broadcast a "muckraking" exposé-style television news report damning the project, and cold fusion in general. The project was portrayed as a government waste and fraud. Japanese television viewers would be inclined to believe the worst because many government projects in Japan are, in fact, boondoggles. The cameramen attended ICCF-3 but they did not use the footage of lectures or interviews. Instead they portrayed themselves as muckraking reporters who had to sneak around stealing information from hostile scientists and bureaucrats. They set up a hidden camera in a car parked across the street from a restaurant where an NHE planning session was being held to give the impression they were catching people going into a nefarious, back alley, secret meeting. In fact, the reporters had been invited to attend the meeting and set up the cameras inside, but they declined. Later, they interviewed a low-level bureaucrat assigned to the project. They blurred the image of his face and disguised his voice. He said, "MITI forces us into projects like this by telling us that if we do not participate, they will not let us into the real juicy plums later on. Nobody really wants to do it." If corporations were pressured to contribute to the project, that would explain the hostile attitudes of the researchers Mizuno met and the internal sabotage and poor planning.

We can only speculate about what happened inside the NHE. From my discussions with Miles and the atmosphere Mizuno describes with despondent researchers taking refuge in his lab, I suppose morale went to pieces. After years of failure, people lost hope and began looking for scapegoats. They picked Fleischmann and Pons. They took steps to cover up their mistakes and hide data. I think they hid positive data for the same reason MIT did in 1989. Not because they feared the data shows excess heat—by that time, they were convinced there can be no such thing. They feared that release of the data might prolong a useless controversy. They thought the data was meaningless.¹⁶

Perhaps, to put it bluntly, some of these NHE researchers were inept. Thomas Edison founded a famous industrial research laboratory, the world's first, which you might assume was filled with the best and brightest. Actually, it was "a veritable cuckoo's nest of learned men, cranks, enthusiasts, ambitious youth, plain muckers, and quite insane people." One of the supervisors complained that, "Our present staff of juveniles are excessively stupid. All of them combined have not as much common sense as would be required to keep a ton of pig iron from floating out to sea in a calm."¹⁷ Research laboratories attract strange people. The work is nebulous and specialized, making it difficult to tell what people are up to and who is to blame when things go wrong. How would the NHE managers know their staff was misinterpreting the XPS studies and not seeing the silicon contamination? The managers themselves did not have the necessary skills. The staff went on making this mistake for almost four years. If this had been conducted as open, academic research, they would have published papers, shared data with Fleischmann and anyone else who asked, posted data on the Internet, and invited people like Mizuno and Storms into the

lab the first year. The mistakes would have been caught early on.

I doubt the NHE engineers were dolts. They were not to blame. The problems were caused by high-level management mistakes and inflexible plans. Most big-company Japanese engineers are smart, and Asami ran the NHE the way a good research lab should be run, but even good people can find themselves in over their heads. Cold fusion is tough! The NHE picked the most difficult experiments, with bulk palladium and heavy water. Even McKubre, with all his resources and expertise, can barely replicate his own results with this method. Good people need good leadership and clear direction. They need leaders with a broad grasp of the field. The managers should have begun by making a broad survey of the field and inviting experts like Storms, Mizuno, and Fleischmann to visit and consult. They brought in only Storms, when it was too late. I criticize the engineers for not reading Storms' paper describing excess expansion, but how can they have known it existed? An engineer at Hitachi who speaks little English will not know about a paper in an obscure, out-of-print conference proceedings.

Some Anthropology

I do not know what happened inside the NHE, but I can speculate based on what takes place in other dysfunctional Japanese institutions. Bear in mind that all organizations in Japan are unique—they do not fit a rigid pattern any more than American organizations do. They are not all dysfunctional, by any means! And they are organized in many different ways: the PTA is nothing like the Mafia. But they draw on the same traditions and culture, so they have recognizable patterns, just as American or French organizations do.

Asami's management techniques, as described by Melvin Miles, are in the classic tradition of Japanese management, which stretches back hundreds of years. He ran things the way an old-fashioned Japanese boss would do it, with weak supervision, autonomy and responsibility given the individual, yet with strong, healthy group bonding. Some American cold fusion scientists have said to me: "Asami is a nice guy, he is really on our side, he is still working behind the scenes to revive the program. Don't blame him. He was just following orders." This is a misreading of Japanese culture. Japan has a reputation for being a conformist society where low-level peons knuckle under and follow orders. The catch is, those low-level peons are the ones who write the orders in the first place. Pressure to conform does not only come from above, it is peer pressure from co-workers. A great deal of power in organizations usually resides in the lower ranks.¹⁸ The leaders are often figureheads, or weak nonentities. This is not a democratic tradition. The Imperial Japanese Army was largely run on this basis, as were eighteenth century samurai bureaucracies.

At its best, this tradition serves democratic populist ideals, empowering the factory worker, the researcher, and the young. At its worst, it leads to autocratic control by an irresponsible minority, like the small group of southern politicians who once dominated the U.S. Senate by manipulating rules and filibustering. Projects are stymied by low-level functionaries. Decision makers are invisible, like the anonymous authors of the NHE Final Report. They may be ambitious young executives. Many historians feel that up-and-coming junior army officers of the 1930s set policy and pushed the nation into war. At the other end of life, retired people with no official standing act as behind-the-scenes "advisors," pulling strings and manipulating events, while accepting no responsibility for their actions.

In a mismanaged, unhappy Japanese organization, workers may have broad autonomy and responsibility, but they strangely lack the power to change their own job description, and nobody knows who wrote the job descriptions. Tasks are frozen. Project goals cannot be changed because the clash of factions

allows only weak, compromise leaders to emerge. No one is in charge, and no one has the authority to make changes. Each department is a separate fiefdom:

The inability of Todai [Tokyo University] to take practical measures for reform from within is simply the latest symptom of the increasing paralysis of the university's decision making processes. These processes display in a more extreme form features often found in Japanese decision making, such as the preponderant weight of lower strata, the existence of figurehead entities toward the top, the osmosis of consensus from the bottom upwards, the principle of unanimity rather than majority rule, and the long strung-out *shingikai hôshiki* (deliberative consultation method). When it comes to consensus and decisions, Todai is a bowl full of jelly.¹⁹

If the NHE program was sabotaged deliberately, my guess is that it was sabotaged in the traditional style by a faceless, junior, back-office accountant who arbitrarily sliced the budget to cover the cost of the Kobe earthquake disaster,²⁰ or by a disgruntled faction of mainstream physicists acting incognito, or by a retired busybody, string-puller like Arima. Most likely, it was destroyed by institutional paralysis that reduced it to "a bowl full of jelly." The least likely scenario is that it was done-in by an organized conspiracy of men at the highest levels who planned and secretly manipulated events, like the bad guys in a James Bond movie.

References

1. Asami, N., Matsui, K., and Hasegawa, F. 1995. "Present Status and the Perspective of New Hydrogen Energy Project," *Proc. ICCF-5*, 87.
2. Pollack, A. 1997. "Japan, Long a Holdout, Ending Cold Fusion Quest," *The New York Times*, August 26. This article said the program cost 2.3 billion yen (\$23 million at today's exchange rates). M. McKubre (SRI) heard that the program was originally budgeted \$30 million, but this reduced when MIT made across-the-board cutbacks to cover the expense of the Kobe earthquake. Other sources say \$30 million was spent.
3. Miles, M. 1997. "Anomalous Effects in Deuterated Systems," *Infinite Energy*, 3, 15/16, 35.
4. Miles, M. 1998. "NEDO Final Report, Electrochemical Calorimetric Studies of Palladium and Palladium Alloys in Heavy Water," March 31, 32 pages.
5. Crouch, T. 1989. *The Bishop's Boys*, Norton, 226.
6. Riordan, M. and Hoddeson, L. 1997. *Crystal Fire: The Birth of the Information Age*, Norton, 137.
7. Rothwell, J. 1996. "Critique of the NHE Experiments: An Open Letter to the NHE Lab Directorate," *Infinite Energy*, 2, 10, 28.
8. Ikegami, H. 1993. "The Next Steps in Cold Fusion," *Oyou Butsuri*, 62, 7, July, 717.
9. Fleischmann, M. *Icarus System Handbook*, Ver. 2, unpublished NHE document.
10. Mallove, E. 1999. "MIT and Cold Fusion: A Special Report," *Infinite Energy*, 4, 24, 118. Deutch has recently been in hot water because he loaded highly classified CIA files onto his home computer, which was linked to the Internet.
11. Sanger, D. 1992. "Japan's Nuclear Fiasco," *The New York Times*, December 20.
12. Reuters reports, December 8, 9, and 10, 1995; NHK claimed five tons leaked.
13. *Nucleonics Week*, April 22, 1999.
14. Nihon Keizai Shimbun, November 1, 1999, www.nni.nikkei.co.jp/FR/FEAT/nuclear/nuclear00049.html.
15. Pollack, "Japan, Long a Holdout. . ."
16. Mallove, "MIT and Cold Fusion. . ."
17. Conot, R. 1979. *A Streak of Luck*, Seaview Books, 258.
18. Vogel, E.F. ed. 1975. *Modern Japanese Organization and Decision-making*, University of California Press.
19. *Ibid.*, 316.
20. M. McKubre heard this is what happened; see Reference 2.



An Energy Source by Any Other Name...

Internationally, momentum is growing toward acceptance of unorthodox energy research. The tempo of new conferences, books, and newsletters about it increases each year. It is the time of birth for a new view of physics.

Around the world, researchers network information on the emerging energy science—on radically different and unorthodox ways to generate electrical energy. Gravity fields, magnetism, vibrations of space itself are seen as a source of clean energy!

Retired NASA consultant Dr. Rolf Schaffranke concludes, "There is now overwhelming evidence for the actual existence of a very high density, energy rich space continuum formerly called 'ether.' This space energy can be concentrated, gathered, focused, magnified and compacted by magnets or magnetic materials, which appear as the new core materials for converters of all kinds, utilizing the cosmic energy for new technology applications."

In his book, *Ether Technology*, Dr. Schaffranke describes scientific experiments of T.T. Brown with charged bodies in a high vacuum. The experiments "suggest the actual presence of certain fields in vacuum; whether we call them gravitational field, tachyon-field, ether-field, neutrino-or Fermi-sea, etc. is of secondary importance at this moment." Dr. Schaffranke places more importance on the fact that although Brown spent more than \$200,000 of his own funds over several decades, he had not been able to have the results published in the scientific media of the U.S.A.

However, in the opinion of this journalist, the 1990s, the Turnaround Decade, may be the time when the public realizes what's happening in non-conventional energy research.

Right now, even the average Joe or Jane knows that humankind has fouled its nest with oil spills, nuclear contamination, and acid rain. Millions of sensitive Joes and Janes—especially young ones—feel despair for their planet. Hopelessness builds apathy, so a major jolt of good news is desperately needed.

When will the infusion of hope be injected through the mass media? The answer is partly up to researchers—people will believe a low-cost clean energy technology is possible when they see it powering cars, stoves, and stereos.

But the leap from proof-of-principle devices to marketable hardware is financially formidable, and maverick researchers generally struggle along with little money. Many believe that forces (mostly inertia) against non-conventional energy research hold most of the cards right now. More conventional scientists control government funding, academic prestige, and status as "experts."

Don Kelly, wrote in a recent letter "...there is no longer any question about the validity of free energy." But "we're still considered to be the 'lunatic fringe.'"

When a new world-view is in gestation or even still in its infancy, it's pretty easy to deny its existence.

In the case of the radically innovative energy technologies, those who have conceived of the new science can't even agree on a name for their offspring. So how can there be a birth announcement?

Readers of this journal may feel more comfortable with the name Sympathetic Vibratory Physics. But some others may not

resonate to Sympathetic Vibratory Physics. Those who don't know about the concepts of one of the fathers of free energy research, John Keely, and are not students of the laws of nature regarding vibration and sound, may be unmoved by the name.

Nor is there agreement on use of the name Free Energy. "Free" is a four-letter word which raises hackles in some circles because "there isn't any free lunch." The f--word must be replaced by a more respectable moniker, most people in the field admit.

Conference speakers suggest various, more respectable appellations. Dr. H.W. Jones of La Habra, California, for example, was a speaker at an international gathering in Einsiedeln, Switzerland in October, 1989. He is a retired U.S. Naval officer with a doctorate in physics. In an aside during his speech, he commented that the term "free energy" means heresy in the view of many learned scientists. He suggested to the audience of about 700 fellow researchers that they avoid the term, while acknowledging that the conference hosts, Swiss Association for Free Energy, use it in their organization's name.

Dr. Jones says, "I suggest we call our devices 'energy converters,' and avoid making initial claims of over-unity efficiency. This may help achieve much-needed credibility as we seek to persuade the science advisers or patent examiners of the validity of our devices."

Elsewhere in his talk, the dignified speaker calmly noted that "some of you have suffered professional abuse at the hands of otherwise well-intentioned scientists who debunk your efforts. There seems to be a professional pride, even egomania, by many 'establishment' scientists who, in their self-satisfaction, are firmly convinced that a novel energy device is fallacious if it cannot be explained by existing 'laws of Physics' as we know and understand them."

And the establishment does hold the cards. "Venture capitalists and patent examiners rely on the opinions of science advisers in deciding whether to support or reject a novel idea."

Dr. Jones emphasized, "It is our task to make zero-point technology recognized and accepted by the scientific community."

The next step? In his opinion, it's up to "the theoreticians among us to re-examine fundamentals of physics and electrodynamics" with the aim of "developing system models which can reconcile the results being achieved by experimenters."

He reviewed some fundamentals of physics for the audience, leading to his statement that "our challenge is to tap and utilize the individual potentials of scalar electromagnetics, thus providing limitless free energy. That is what some of our experimenters have been accomplishing with their novel circuitry. In the interference zone where two scalars get together, they combine into usable vectors, and we can then measure the output by conventional voltmeters, ammeters, and wattmeters. T.H. Moray was using scalar interferometry in his generators fifty years ago."

Dr. Jones invited the Einsiedeln audience to look at other Zero Point studies, such as a recent paper in *Physical Review* by Dr. Harold Puthoff on "background (vacuum) electromagnetic zero point energy."

Various studies Dr. Jones cited "affirm that our present day electromagnetics are merely special cases of the general electrodynamics theses developed by Nikola Tesla many decades ago. The 'Tesla wave' is the basis for our present studies of scalar waves, and I am inclined to believe that herein exists the validation of so-called Free Energy devices."

As president of Engineering Research Institute, Dr. Jones is putting his words into action; his institute is working on theo-

J.L. Manning*

Reprinted with permission from

The Journal of Sympathetic Vibratory Physics

retical support for the new breed of experimenters.

These brief excerpts from his speech at Einsiedeln illustrate the point that a new technology is being born.

While he gave credit to Dr. Hans Neiper of West Germany for putting the name Gravity Field Energy on the tongues of countless researchers, Dr. Jones also suggests widespread use of a name which others have already bestowed—Zero-Point Technology. He exhorted experimenters to “please continue your zero-point work. Use intuition; the theoreticians will eventually catch up. Peter Graneau is exploding water into vapor without adding heat. They said it couldn’t be done. Pons and Fleischmann may have achieved cold fusion; conventional physics says it is impossible. Eric Laithwaite can demonstrate an energy linkage between spinning gyros, which of course is impossible in theory. It is exhilarating to break the constraints of existing scientific dogma.”

Another main speaker at the Swiss conference was Dale Pond of Colorado Springs. While speaking about Sympathetic Vibratory Physics, he warned the audience that materialistic science will resist the new paradigm. One of the premises of materialistic science is insufficiency—“this false idea of there not being enough energy or materialistic substance to go around.”

“With a broader paradigm that concedes the universal forces of nature are limitless, mankind can then be charitable.” But many are hesitant to concede this, he said. “It implies their knowledge and power structures are based erroneously on false premises.”

He added that the ideas of endless abundance imply sharing. “Most refuse to share because they believe in limited materialities as opposed to limitless potentialities.”

In its infancy, then, this mutant science may be a nuisance to the establishment scientists, government bureaucrats, and the power elite. But when it is full-grown, according to some visionaries, the new energy science may be the savior of Planet Earth.

The unorthodox energy science has been given many other names, besides clean energy or Tesla technologies. Paramahansa Tewari, a chief project engineer with the Nuclear Power Corporation of India, writes about Space Power generators; T.H. Moray of Utah said his device used Radiant Energy; Dr. Wilhelm Reich taught about Orgone energy; the U.S. Department of Defense in a call for proposals has referred to “Esoteric sources of energy”; Tom Bearden talks about Scalar Energy; researchers Walter and Rhett Baumgartner work on Vortexian Mechanics after having studied the writing of Victor Schauberg-er, Walter Russell, and others.

Some researchers who claim to have devices which put out more power than it takes to run them call the phenomena Over Unity.

At the Swiss Association for Free Energy conference, Stan Meyer of Ohio unveiled his plans for a Water Fuel Cell Technology. Making hydrogen at point-of-use is a hot topic today in alternative energy circles.

One of the scientists who flew to Einsiedeln for the conference was Lynn Surgalla. She is a former planner/analyst for the NAVSTAR Global Positioning System and currently teaches biophysics at State University of New York in Buffalo. In a brief interview, one of her comments was, “The answers to energy and environmental crises are here. But they just aren’t being funded.”

That statement is echoed by speakers at other clean-energy conferences attended by this journalist.

What if a Manhattan Project level of funding was bequeathed to the infant technology? Could it then grow and develop swiftly, with far less struggling, and news of its birth and its wobbly first steps fill the media?

If so, then millions of individuals buoyed by hope could turn their apathy into action and join forces internationally in a bat-

tle to save the ecosystems of their planet.

With a low-cost source of clean energy, they could also convert polluted water into life-giving water.

With hope instead of despair, these activists could turn their attention to fellow humans in Third World situations. In a world with abundant clean energy, the masses of have-nots could enjoy a decent standard of living without overwhelming Earth’s ecosystems.

It would take wisdom and vigilance from world leaders to nurture and shape the emerging technology—whatever it is called—into a peaceful benefactor for the planet and its inhabitants.

References

Schaffranke, Dr. Rolf. *Energy Unlimited* newsletter #12, available from Energy Unlimited Publications, P.O. Box 493, Magdalena, NM 87925.

Schaffranke, Dr. Rolf. 1972. *Ether Technology*, Lakemont, Georgia.

Proceedings of the Swiss Association for Free Energy International Congress, Einsiedeln, Switzerland, October 1989.

By permission of Don Kelly, Technidyne Associates, Clearwater, Florida. Private correspondence with author of this article.

Also cited, *Kelly’s Free Energy: The Final Solutions* folio.

Moray, Thomas. 1978. *The Sea of Energy*, Salt Lake City, Utah, Cosray Research Institute.

About the Author

Jean Manning, author of *The Coming Energy Revolution*, lives in British Columbia, Canada. Since 1983 she has interviewed hundreds of scientists, inventors, and other thinkers researching “new energy.” As a sociologist, environmentalist, and seeker of wisdom she is most interested in the potential for a new energy science, and subsequent knowledge of interconnectedness, to empower people on various levels. Her books are published in five languages. She is the mother of two sons and one daughter and has worked in radio, edited a small town newspaper, was staff writer for a regional magazine, and reporter



for two city newspapers. Currently Jean is on the planning committee for the Climate of Change Congress to be held March 19-22 in Victoria, British Columbia.

*e-mail: visionary@bc.sympatico.ca

***If you're going
through hell,
keep going.***

—Winston Churchill

Former Electrical Engineering Professor Has NASA Grant for Free Energy Device

According to an intriguing article in *New Scientist* (January 22, 2000, pp. 32-34), "Energy Unlimited," by journalist Henry Bortman, NASA has given a three-year grant, beginning in 1999, to make a solid-state free energy device. The recipient is Jordan Maclay, former professor of Electrical Engineering at the University of Illinois at Chicago. Maclay has formed a company, Quantum Fields, in Richland Center, Wisconsin, to experiment with extracting zero point energy (ZPE) from space. His approach will be to employ an elongated tiny metal box—the size of a tiny *e. coli* bacterium (less than a micrometer in length)—to see if he can extract energy from the box's differential oscillations in the ZPE field. The oscillations would be set up, in theory, by the different Casimir pressure forces from the quantum fluctuations in space, on the specially shaped metallic box. The company's web site is: <www.quantumfields.com>.

NASA's Marc Millis, who heads the Breakthrough Propulsion Physics program, is optimistic that this or other handful of projects in the program will lead to radical new forms of space propulsion.

Clinton Requests Funding for Anti-Global Warming Initiative

In his latest Federal budget request, President Bill Clinton has asked Congress to approve \$2.4 billion—a 42% increase over last year's budget—for various efforts to combat alleged global climate change due to human activity. An Associated Press report of February 3 states, "Part of the new money would go toward a push to accelerate development and distribution of clean energy technologies worldwide." This certainly

makes one wonder whether any of this money will find its way to supporting low-energy nuclear reactions and other new physics energy sources that *Infinite Energy* has chronicled for the past five years. Probably not.

Chinese UFOs Make Front Page of *The New York Times*!

The headline on the front page of the *New York Times* (January 11, 2000) was startling for this staid publication, "A U.F.O. Boom Doesn't Worry Chinese Rulers." It bannered a lengthy article by Elizabeth Rosenthal. She reported that in China there are now some 40,000 members of UFO research organizations and that the pursuit is not discouraged by the Chinese government. Many of these researchers are scientists and engineers, she wrote. Some of the groups require published research or academic credentials for membership. Rosenthal quotes one researcher, Mr. Sun: "In the U.S., scholars investigating this are under pressure and have been derided. But in China the discussion is quite free, so in this area American academics are quite jealous of us." On the other hand, the article notes, the Chinese government has jailed members of the Falun Gong spiritual/alternative health movement. Apparently, a distinction is made in China between the relative credibility—or safety—of UFO study and the *organized* pursuit of the traditional Chinese *qigong* exercises.

U.S. Energy Secretary Richardson Initiates Anti-Discrimination Program

Though Energy Secretary Bill Richardson has yet to call for a halt to discrimination against cold fusion research—bootlegged or otherwise—at federal laboratories, he ordered all Energy Department offices and laboratories closed for

half a day for "anti-discrimination training sessions." This according to a report in *The New York Times*, January 20, 2000. Now let's see, if the U.S. DOE payroll is X-\$billion, then the cost of this exercise was at least X/520-\$billion, still a lot of money. Richardson is also seeking \$10 to \$15 million in the next budget cycle to recruit more scientists, "particularly Asian-American ones," for the energy laboratories.

The Richardson training edict was designed to counter accusations that Los Alamos National Laboratory weapons scientist, Asian American Wen Ho Lee (who is in jail awaiting trial on charges of downloading highly classified information to an unsecured computer), might be the victim of generalized discrimination at the labs. Richardson, a Hispanic-American, is himself a member of a minority group.

Conversely, ex-CIA Director John Deutch, now back at MIT as a chemistry professor, is *not* in jail. He did roughly the same thing that Wen Ho Lee did—downloaded highly classified information to his unsecured computer. Except in the case of Deutch, an unsecured Macintosh computer containing those files went home with him and was connected to the internet! Deutch carried out e-mail exchanges with uncleared persons and some member(s) of his family (Deutch himself?) apparently visited porn sites from this Mac, according to a report in *Time* magazine. John Deutch, however, has only belatedly lost his various security clearances, by which he was able to continue his lucrative consulting business with various military contractors. He is not in jail. Close readers of *Infinite Energy* may recall from Issue No. 24 (p. 118) that Prof. John Deutch, then MIT Provost, in an April 12, 1989 press release from the MIT News Office, stated: "We are pleased to see professor Halgelstein proposing an explanation for 'cold fusion' and we are encouraging investigators both here and at other research institutions to continue their work on this most surprising phenomenon, which may have enormous consequences." Of course, as Director of the CIA, Deutch had nothing further to say about cold fusion—as far as we know. Perhaps he would now consider e-mailing us about

the topic from his Macintosh? Cold fusion work doesn't require security clearances, although you might get fired from your job at some federal labs or the Patent Office, if it is found that you are working on it.



McCain 1, Gore 0, Bush 0

In the last issue of *Infinite Energy* (No. 29, p. 41, 68), we reported that Senator John McCain, running in the New Hampshire primary for the Republican presidential nomination, had agreed to be briefed on cold fusion. He kept his word. Within a week of his promise, he sent a top aide to our offices at the Bow Technologies Center. Eugene Mallove gave this aide, Tim Lennon (Field Representative for New Hampshire), a one-hour briefing that was eye-opening. He received briefing materials which were to be handed to the Senator. Thus, Senator McCain became the very first major party presidential candidate in history to receive a high-level briefing about cold fusion. This briefing occurred *before* he won the February 1, 2000 New Hampshire primary by a large margin over Governor Bush of Texas and others.

Eugene Mallove later sought to ask Vice President Al Gore, while Gore was campaigning in Concord, New Hampshire for the Democratic Presidential nomination, whether he too would agree to a cold fusion briefing. On January 13, Mallove attended a Gore question-and-answer meeting at Temple Beth Jacob in Concord, but was unable to ask Gore the question—the Vice President was very long in responding to so many of the other questions that time simply ran out. After the meeting, a Secret Service agent would not receive the question, which had been typed on a sheet, for submission to Mr. Gore. The agent referred Mallove to a Gore top aide as Gore autographed papers in the post session. In the jostling crowd around Gore, the aide promised Mallove several times that he would personally hand the material to Gore—the type-written question, *Infinite Energy* tenth anniversary of cold fusion Issue No. 24, and the videotape Cold Fusion: Fire from Water.

Subsequently, it was learned that all the material and the question was left at the Temple by the aide, for reasons unknown. Mallove later brought the material to the Gore headquarters in Concord, where lower echelon campaign

workers promised to see if they could get the material to Gore. In fact, proposed cold fusion briefings have been “chasing” Mr. Gore for many years now, with no success. As reported in *Infinite Energy*, No. 18 pp. 42-43, in the early 1990s Vice President Gore deliberately refused to receive a cold fusion briefing by qualified scientists, after being urged to do so by a colleague at the Apple Computer corporation. Gore then reportedly stated that the topic was “too controversial, too complex—give it to the science advisor.”

For the record, the question that was handed to Gore's representative on January 13, 2000:

Question for Al Gore from Dr. Eugene F. Mallove, Bow, NH

Mr. Vice President:

I'm Dr. Eugene Mallove, a member of this Temple and editor of the scientific journal *Infinite Energy* magazine. I would like to ask you two critical questions about energy and the environment, because I know those topics are dear to you—it may even help you win over Bradley because of the boondoggle going on in his state at Princeton! [Editor's note: The Princeton tokamak fusion reactor.] I hope that you will be very forthcoming in your response—as Senator John McCain was when I asked him last week in Bow, at a Town Hall Meeting. You can be instrumental in ending a scientific scandal over energy that has been going on since the Exxon-Valdez ran aground on March 24, 1989—the day after Drs. Fleischmann and Pons made their cold fusion announcement at the University of Utah. Candidate Bill Clinton, right here in this room on January 12, 1992, told those assembled that he knew something about the scandal—he said Department of Energy scientists had “stonewalled Arkansas scientists.” Despite that, I regret to tell you he has done nothing about it except make the scandal grow worse. Here are the two questions:

1. Will you agree to help end the Cold Fusion controversy by agreeing to a scientific briefing here in New Hampshire, by representatives of the hundreds of American scientists working in the cold fusion and low-energy nuclear reactions field—including my colleague Dr. Edmund Storms of Los Alamos National Laboratory?
2. After this, would you consider proposing a National Academy of Sciences review of the cold fusion and low-energy nuclear reactions issue based on the large body of scientific evidence that has built up since what we regard as the indefensible, rush-to-judgment, even fraudulent report by the Department of Energy in 1989?

Optional addition:

For the benefit of those in the audience who may not know: One of the most potent renewable energy sources is nuclear fusion energy—the idea of fusing the heavy hydrogen in all water to produce helium. In only one cubic kilometer of ocean there is enough heavy hydrogen—1 part in 6500—to produce energy

equal to all the known oil reserves on earth, and there are at least a billion such cubic kilometers on Earth. The U.S. Government has spent some \$15 billion dollars over the past forty to fifty years on so-called magnetic confinement “hot” fusion, and in the Clinton-Gore administration alone this has amounted to some \$2 billion dollars. This is in our view a doomed white elephant program that is going nowhere and would lead to further environmental problems if it ever were successful fifty years from now.

On the other hand, there is now 100% proof in peer-reviewed literature that cold fusion represents a new energy source of stupendous importance to our industrial civilization, Earth's environment, and the remediation of nuclear waste. It is presently at the level of where the transistor was at about 1950. It would have been much further along had it not been slandered and obstructed by incompetent, fraudulent bureaucrats and their academic pork barrel hot fusion program. There would have been no controversy at all about this at this late date had members of the hot fusion establishment and their admirers in academe not been so selfish and bigoted about this.

— End of question—

We are not holding our breath for an answer to this question. Of course, we would welcome a serious answer—*any* answer—if it ever came!

Despite three attempts to get Presidential candidate George W. Bush to respond to cold fusion questions, no response has been received.



Nobel Laureate Julian Schwinger Attacked Posthumously in *The New York Times* for Cold Fusion Interest

It has been common among establishment physicists to criticize the late Nobel laureate Julian Schwinger for having gotten involved in cold fusion theorizing. The *New York Times* website recently contained the following pathetic comment by Dr. Benjamin Bederson, a physicist at New York University: “Saddest of crackpot theories come from superannuated, formerly fine scientists who late in their careers get bored doing bread-and-butter stuff.” The NYT author reported Bederson's further comment: “A classic example, he said, was the renowned physicist Dr. Julian Schwinger, who in old age believed he had found a scientific explanation for cold fusion, a scheme for producing energy that was soon shown to have no basis in reality.”

Sad, very sad, is Bederson, not Schwinger. Presumably Bederson feels elevated and somewhat superior to Schwinger for “knowing” that “cold

fusion has no basis in reality." Bederson should go back to "bread-and-butter stuff" and leave wise cracks to the TV comics. The remark may still be there at:

<http://www.nytimes.com/library/national/science/010400sci-physicstheory.html>



Fusion Technology Seeks New Editor

The notice reprinted below is important to the cold fusion field because of Professor George Miley's stewardship of the journal. It can be found at:

< <http://fed.ans.org/fed.html> >.

"The American Nuclear Society (ANS) is soliciting names of qualified members who have an interest in becoming the editor of the ANS journal of *Fusion Technology*. Professor George Miley of the University of Illinois is the founding Editor of this journal and has served as its editor since its inception in 1981 as *Nuclear Technology/Fusion*, switching to *Fusion Technology* in 1984. He has done an outstanding job. Professor Miley has indicated that he intends to retire from the Editorship in approximately two years. The ANS is thus seeking a qualified individual to take his place. The selected person will be appointed 'Editor-Designate' by June 2000, will work with Professor Miley to effect a smooth transition, taking over the full editor role by about January 2001. . ."



Theory Suggests Vortex Could Create "Optical Black Hole" on Earth

A theoretical paper in the January 31, 2000 *Physical Review Letters* by two scientists at Sweden's Royal Institute of Technology proposes that laser light beamed into a fluid vortex could create the effect of a light-trapping "black hole" in the laboratory. The authors of the theory are Dr. Ulf Leonhardt and Paul Piwnicki.

There is a catch to this, so don't start experimenting with your bathtub drain yet! The fluid would have to be one in which the speed of light has been substantially slowed down. Widely reported in 1999, Dr. Lene Vestergaard Hau of Harvard University and Dr. Stephen E. Harris of Stanford University demonstrated that light could be slowed to 65 km/hour in a cluster of ultracold sodium atoms—a so-called Bose-Einstein condensate. Leonhardt and Piwnicki propose

that laser light beamed into such condensates, set to rotation with linear velocities in the range 1 to a few 100 meters/second, might create effective black holes. The entrapped light would be dragged down into the eye of the vortex and dissipated. The two theorists suggest that the analogy between the terrestrial experiment with a swirling Bose condensate and astrophysical phenomena linked with purported black holes would be strong. Perhaps models of cosmic events could be brought down to Earth.



ExxonMobil Ad Predicts Eternal Fill-Ups!

The newly formed entity called ExxonMobil, a merger of the two original oil super-companies, has been running ads in major U.S. newspapers to get customers used to the new corporate logo. The ad says, in part, "Each year millions of people become drivers. As their demand for energy grows, so does the complexity of providing it. To meet their needs will take an infusion of new ideas, technology and talent. Together, that's what we will have. What won't change is where these new drivers fill up. At Exxon and Mobil stations." The comfortable presumption, of course, is that people will be "filling up" with black gold indefinitely. We'll see about that! "New ideas, technology, and talent"? Hey, ExxonMobil, we've got some! Please call us at your convenience.



Infinite Energy's Editor-in-Chief Appears in Science Fiction Story

The October 1999 *Analog* (pp. 12-37) features a science fiction novella about time travel, "Late Lessons," by Paul Levinson. The characters contemplate the hazards of interfering with events that may have occurred at the end of March 1989, such as the Fleischmann and Pons cold fusion announcement at the University of Utah on March 23 and the Exxon-Valdez running aground and spilling millions of gallons of oil off Alaska on March 24.

One character, "Jeff," relates to "Laura": "The two dates are a classic in techno-cultural history—the solution to fossil fuel pollution unveiled but one day before the most publicized incident of pollution in the century. Every school kid

knows it. There's a famous *Analog* article about that coincidence by Mallove that everyone reads in the seventh grade—"

The *real* article being discussed is "Cold Fusion: The 'Miracle' Is No Mistake," by Eugene F. Mallove in the July/August 1997 *Analog*.



International Congress 2000 Scheduled

The International Congress 2000 on Fundamental Problems of Natural Sciences and Engineering is scheduled for July 3-8, 2000 in St. Petersburg, Russia. Congress 2000 is dedicated to new ideas in natural sciences and engineering that would contribute to bringing together presently disconnected branches of science through a unified approach.

Problems to be Discussed

1. Fundamental problems of contemporary age—space-time, gravitation, electrodynamics, dynamics of ether, real processes.
2. Constitutive elements, structure, and interactions in science on the Earth and Universe.
3. New approaches to the problems of energy, engineering, and technology.

Plenary sessions, discussions in sections, and poster expositions will be held in the main building of the St. Petersburg State University at the University campus in Peterhof (a suburban town in the vicinity of St. Petersburg), where all accommodation and meals will be provided for participants of the congress.

For further information about Congress 2000, contact the organizing committee at:

International Scientists Club
36 Kazanskaya st.
190031 St. Petersburg Russia
Fax: +7 (812) 312-8565
Email: science@shaping.org
Internet:

<http://www.physical-congress.spb.ru/>

Note to regular *Infinite Energy* readers: Due to intense development and testing work on a number of fronts, we decided not to present a Device and Testing Update section in this issue. Look for it next issue.

—NEERL Staff



NEW ENERGY UPCOMING EVENTS

8th International Conference on Cold Fusion

May 21-26, 2000



The 8th International Conference on Cold Fusion, ICCF-8, will take place in Lerici, Italy, May 21-26, 2000. The study of Cold Fusion phenomena, sometimes referred to as "New Hydrogen Energy," is progressing in numerous laboratories all around the world. More than ten years old, the field is enjoying ever more reproducible experiments and a better interaction with the scientific community. A large variety of experimental approaches will be addressed in the Conference together with theoretical attempts to interpret the observed phenomena.

The Conference will consist of oral and poster presentations. The official language of the Conference is English. Pre-registration, registration and submission of abstracts should preferably be performed using the Conference Webpage:

www.frascati.enea.it/iccf8

List of Topics:

- Heat and related products
- Nuclear processes and transmutations
- Materials
- Innovative approaches
- Theories

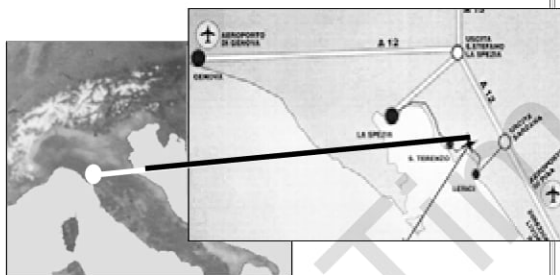
Organized by: The Italian Agency for New Technologies, Energy and the Environment
With the sponsorship of: Consiglio Nazionale delle Ricerche (CNR), Istituto Nazionale di Fisica Nucleare (INFN), and the Società Italiana di Fisica (SIF)

ICCF-8 Secretariat:

M.L. Ciceroni
ENEA C.R. Frascati
Via Enrico Fermi, 45-
00044, Frascati
(Roma) Italy
phone:
(0039)-06-94005854
e-mail:
iccf8@frascati.enea.it



VILLA MARIGOLA, Lerici
(La Spezia, Italy)



Lerici is a beautiful little seaside town in the "Golfo dei Poeti," on the Tirrenian coast. The closest airports are Pisa (80km) and Genova (100km).

Pisa is connected daily to: Munich, London and Paris.

Genova is connected daily to: Frankfurt, Zurich, London, Munich. There are domestic flights connecting Pisa and Genova with Milano Malpensa and Roma Fiumicino. Once in Pisa or Genova, you can reach La Spezia by train.

The trip takes about one hour. From La Spezia a bus will take you to Lerici in about fifteen minutes. A shuttle service to and from airports at the beginning and at the end of the Conference is being considered. More detailed information about travel and site are available on the Conference webpage.

CALENDAR

EarthFair 2000

April 22, 2000
Washington, D.C.

Small Fuel Cells and Battery Technologies

April 26-29, 2000
New Orleans, Louisiana

International Conference on Science and Consciousness

April 28 - May 3, 2000
Albuquerque, New Mexico

ICCF-8, Eighth International Conference on Cold Fusion

May 21-26, 2000
Lerici (La Spezia, Italy)

The Natural Philosophy Alliance Meeting

June 5-9, 2000
Storrs, Connecticut

Midwest Renewable Energy Fair

June 16-21, 2000
Madison, Wisconsin

35th Intersociety Energy Conversion Engineering Conference

July 24-28, 2000
Las Vegas, Nevada

Midwest Renewable Energy Fair

June 16-21, 2000 • Madison, Wisconsin
Dane County Exposition Center
Contact:
Midwest Renewable Energy Association
7558 Deer Road, Custer, WI 54423

EarthFair 2000 in celebration of Earth Day on the Mall in Washington, D.C. April 22, 2000

Features: solar-powered stage will feature international entertainment and top musical acts from the U.S.; hundreds of exhibits displaying all the elements of a sustainable society; sun, wind, earth, water, and people will be powering exhibits, modeling central components of a clean energy future; hands-on activities; children's activities; opportunities for direct action.

Earth Day Network 2000
91 Marion Street
Seattle, WA 98104
Fax: 206-682-1184
Email: earthday@earthday.net
Website: www.earthday.net

International Conference on Science and Consciousness

April 28 - May 3, 2000
Albuquerque, New Mexico

For Registration:
The Message Company
4 Camino Azul, Santa Fe, NM 87505
Phone: 505-474-0998 Fax: 505-471-2584
Email: message@nets.com • www.bizspirit.com

Advances in R&D for the Commercialization of Small Fuel Cells and Battery Technologies For Use in Portable Applications

April 26-29, 2000
Hyatt Regency New Orleans
New Orleans, LA
Register Online at www.knowledgefoundation.com
Tel: (617) 232-7400 • Fax: (617) 232-9171
E-Mail: custserv@knowledgefoundation.com

35th Intersociety Energy Conversion Engineering Conference

July 24-28, 2000
Riviera Hotel Las Vegas, Nevada

Energy and Power in Transition

• Aerospace Power Systems and Technologies • Conversion Technologies • Electrochemical Technologies • Environmental Impact • Energy Systems • Policy Impact on Energy • Renewable Energy Sources • Thermal Management

For additional conference information, contact the American Institute of Aeronautics and Astronautics Customer Service Center at 1-800-639-2422 or custserv@aiaa.org

The New Natural Philosophy: An Introduction to 21st Century Physics and Cosmology

• June 5-9, 2000 •
University of Connecticut, Storrs, CT
Registration Fee \$45
For more information contact Prof. Domina Spencer,
Department of Mathematics,
University of Connecticut, U-9, Storrs, CT 06269

Renewable and Conventional Energy



An Opening to Renewable Energy Friends

by Eugene F. Mallove, Editor-in-Chief

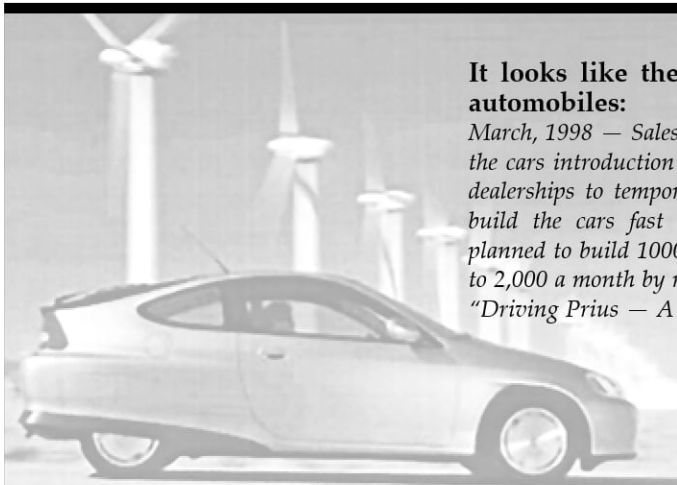
With this issue of *Infinite Energy* we begin a section devoted to reports about "conventional" renewable energy—as well as non-renewable, conventional energy issues. We recognize that many publications already cover these matters more comprehensively than we may ever hope to. Fine examples are the magazines *Home Power: The Hands-On Journal of Home Made Power* and the eclectic *Electrifying Times*. So our intention is not to "re-invent the wheel." The criterion for our much more abbreviated coverage is that the material be especially relevant to the impending "Great Energy Transition." As an example, Jed Rothwell's report on the introduction of hybrid electric cars illustrates the long-delayed creativity in the marketplace that can serve as an example of more remarkable transitions when more radical cold fusion, low-energy nuclear reactions, and other new physics energies come to market.

We take energy seriously—all energy. Some of us at *Infinite Energy* have been concerned with conventional and renewable energy issues for many years prior to coming to terms with the cold fusion announcement of March 1989. I was involved with the development of emergency air-cleaning safety systems for the ill-fated Liquid Metal Fast Breeder Reactor (LMFBR), prior to its demise during the Carter Administration. I acquired a solar hot water heating system for our house in Massachusetts in the early 1980s. There was nothing like a hot shower served by the Sun on a cold mid-winter day! A staff NERL engineer, Ken Rauen, has had experience in revamping hydroelectric power installations in Vermont, as well as more recent inventive activity to add a homemade steam heat transfer loop to the fireplace of his New Hampshire home.

We all have had direct experience with the oil crises of the early 1970s, as well as the oil crunch at the time of the Gulf War, 1990-1991. As this issue goes to press, oil prices have climbed once again to high levels. The scenario is so familiar. Political figures scurry around trying to show concern for the economic hazards of rising energy costs. New tax legislation for this or that palliative is proposed. Potential enduring energy solutions are ignored, or the wrong ones—such as tokamak or laser thermonuclear fusion—are lavishly funded.

Though the main mission of *Infinite Energy* is to chronicle the development of *really new* energy sources—ones that operate on principles that go beyond previously accepted understandings of physics—we respectfully acknowledge that there are devices and methods in the marketplace right now that extract energy from "free" sources, such as wind, hydro-power, solar, geothermal, and various forms of ocean energy. These are good, clean, and creative systems that are available *now*. At present there are no commercial devices in the marketplace that can replace either conventional energy or renewable energy technologies. We know that a profound revolution in energy is coming, based on the observations of new physics that has already occurred in the laboratory. It is inconceivable that this energy will remain a "laboratory curiosity" all that much longer. We view the first decade of the twenty-first century as the time of the Great Energy Transition to infinite, clean energy—the Water Fuel/New Physics Energy Age. We hope that this section, which will address issues closer to the minds and hearts of those already in the renewable energy field, will encourage our renewable energy friends to focus on and prepare for this emerging reality.

Photo credits: Background water photo and inset waterfalls, PhotoDisc™ Vol. 31. Inset Photos: National Renewable Energy Lab/PIX. Top to bottom: geothermal heat pump, U.S. DOE, Craig Miller Productions; ethanol fuel pump, Warren Gretz; natural gas bus, U.S. DOE, Craig Miller Productions; solar dish generator, Warren Gretz; hybrid vehicle, Honda2000 website; heliostat at the DLR solar furnace, Allan Lewandowski



It looks like there is a healthy demand for hybrid automobiles:

March, 1998 — Sales of the Prius in Japan have been so brisk since the cars introduction in December, 1997, that Toyota has asked its dealerships to temporarily stop taking orders. The company can't build the cars fast enough to meet demand. Toyota originally planned to build 1000 cars a month, but it ramping up production to 2,000 a month by mid-summer. - EV World on-line magazine, "Driving Prius — A Brush With The Future"

Hybrid Gasoline Electric Cars Make Headlines

Jed Rothwell

There has recently been a lot of commotion in the media about hybrid gasoline electric automobiles. It began in December, when Toyota and Honda introduced hybrid cars to the U.S. market after selling them in Japan for a year. American automobile makers GM and Ford rushed to introduce their own hybrid vehicles to the public. The Japanese cars look practical and inexpensive. The Toyota Prius seats four, costs \$20,000 and looks like a conventional mid-sized Toyota. The Honda Insight seats two, and also costs \$20,000. The American cars appear to be futuristic, streamlined "concept cars" with exotic features like television cameras and display screens instead of a back mirror, to eliminate the air resistance from side mirrors. I suspect the camera and screen are expensive, fragile, and impractical. The American cars were designed in the federally sponsored Partnership for a New Generation of Vehicles (PNGV), which began in 1994. The government spends \$250 million per year (\$1.5 billion so far), and the manufacturers contribute similar amounts. The Japanese companies financed their hybrid vehicle research and development themselves, without government assistance.

The Toyota and Honda cars are supposed to be on sale now, but supplies are extremely limited. They have been widely advertised on television and in the newspapers. Ford plans to introduce a hybrid car in 2003.

What is a hybrid automobile? It sounds like a Rube Goldberg contraption. A small internal combustion gasoline engine (ICE) runs a generator, which runs an inverter, which recharges a battery, which runs an electric motor, which powers the drive train, which makes the car go. Since energy is lost at each stage, you might think this works out to be the world's least efficient automobile, but hybrid cars are two or three times more efficient than conventional cars, and they generate one-eighth as much pollution. The first-generation hybrid cars travel 28 kilometers per liter in the city, and 34 kilometers per liter on the highway (66 and 80 miles per gallon). This energy saving potential has been known to engineers for nearly a century. The first hybrid automobile was patented in 1908, and the diesel electric hybrid railroad locomotive, which is based on the same principle, has been the dominant type in North America for fifty years.

Although an ICE can run faster or slower, under a heavy or a light load, it works best in a narrow range of speeds and loads, at a setting engineers call the "sweet spot." It can burn up to 40% more fuel outside the sweet spot. In a hybrid car, the ICE always operates at an unvarying optimum speed and load; the

electric motor runs slower or faster. Electric motors work well in a broader range of settings. They are particularly more efficient at low speeds. Some hybrid cars feature complex gearing that automatically couples the ICE to the drive

train directly, once the car reaches high speed. This would be impossible without microprocessor controls.

Energy is not wasted when the car is sitting at a traffic light, with the engine idling. With a pure electric car, the engine turns off and no energy is lost. With a hybrid, the ICE continues to turn, and the energy from it is stored in the battery.

Regenerative braking: with ordinary breaks, as the car slows down, all of the kinetic energy is lost as waste heat—the brake pads get hot from friction. With a hybrid electric car the motors act as generators, slowing down the car and recharging the batteries. Some energy is lost, but some is put aside to start the car up.

An ICE cannot stop turning, which is why the motor must idle at stop lights. An ICE cannot slow down much either. This makes coupling the motor to the drive train awkward. When a car begins moving from a dead halt, initially the drive train turns so slowly that the motor cannot be directly coupled to it, or it will stall. (In other words, with a manual transmission, when you let out the clutch too quickly the motor stops.) The manual or automatic transmission that couples the motor to the drive train is a clumsy, complex machine that wastes energy and pollutes the air with particles of ground-up metal. An electric motor runs at slow speeds much more efficiently.

Hybrid cars are especially promising for city driving with frequent stopping and starting and slow speeds.

Hybrid cars have many advantages over pure electric cars. Electric cars can drive only a short distance between charges, and even with this limited range they must carry many heavy batteries. A hybrid car can drive 850 miles on a small tank of gas and it carries only a few more batteries than a conventional ICE car. Electric cars take a long time to recharge, and most have to be plugged into special receptacles. Hybrid cars fill up with ordinary gasoline anywhere. Electric cars do pollute a little less and they are marginally more energy efficient than hybrid cars.

A hybrid car defies the engineering maxim that simpler is better. The reasons the complex hybrid motor design works well are instructive. They show how a cold fusion-powered car might work. A cold fusion motor would probably generate energy at a steady, unvarying rate, external to the main driving motor. Despite its complexity, a cold fusion engine would probably be more energy efficient than an ICE, for the same reasons the hybrid motor is more efficient. This would not save money, because the fuel is virtually free, but it would reduce thermal pollution and noise, and make cars more compact.

Wouk, V. 1997. "Hybrid Electric Vehicles," *Scientific American*, October.

EV World, online electric vehicle magazine, <http://www.evworld.com/main.html>

Toyota home page, www.toyota.com

Honda web page, <http://www.honda2000.com/models/insight/>

News reports from the AP, *The New York Times* and *The Atlanta Journal*.



Renewable Energy on the Internet

Peter Glück*

Energy is a real-life problem of paramount importance. Actually, all the problems humans have to solve can be considered as:

TRANSPORT		MATTER
TRANSFER	OF	ENERGY
TRANSFORMATION		INFORMATION

Useful for Mankind or parts of it, and as a measure of this "usefulness," a fourth entity, *money* was created. A better term would be "satisfaction" or "value," both being subjective, relative, fuzzy, and indefinable but this is standard for most of human affairs. The entire situation is immensely complex and dynamic.

Recently, very important progress was attained for *information*. It is elementary that this has to be used for the solution of the problems of *energy* and *matter*. The most significant step forward in the information problem is called the Internet; we will show here how it can contribute to a particular aspect of the energy problem.

You can find many Internet sites dedicated to "problem solving," teaching how to confront difficult/complex questions, one of my favorites being:

www.mapnp.org/library

and these are adequate for issues of management. However, in the case of global problems like that of energy, it seems there are no perfect, integral, or definitive solutions.

The current paradigm says, more or less clearly, that energy efficiency (clever savings) plus gradual implementation of the "healthy" renewable sources of energy will guarantee a sustainable development. The basic "trilemma" of "securing energy and resources, maintaining economic growth and preserving the environment"¹ can be solved.

However, even in the very frame of this dominant paradigm there is no unity and no unanimity—take a look at the special issue of *Science* magazine from July 30, 1999 dedicated to "Energy" (www.sciencemag.org in case you are subscribed).

A more critical view of the leading paradigm can be seen at www.altenergy.org.

We at *Infinite Energy* think that sustainability is not possible without really new sources of energy. However, perhaps we can recognize that a common purpose is stronger and more than a difference of opinion. To add to this: scientists and engineers working in the field of energy savings and renewable energies have a great experience—for example in scaling up—which will be useful when the time comes for radical "new energies" such as cold fusion. It would therefore be more clever strategically and politically to create a special kind of cooperation, which was called "*coopetition*" by the creator of lateral thinking, www.edwdebono.com. An initiative in this direction is this present section, which is dedicated to "conventional renewables."

The Main Sites Dedicated to Renewable Energy

Say we intend to start our search from... the very start. We go first to one of the great collections of search engines: www.leidenuniv.nl/ub/biv/specials.htm and ask for search engines specialized in energy.

Here are some of over two thousand sites: www.osti.gov/bridge/home.html and

www.energysearch.com and we can start to look for all kinds of renewable energies by using these or, alternatively, the favorite or proven general search engines. My choice would be, in order:

1) www.google.com, which selects the best websites and eliminates the irrelevant ones.

2) www.alltheweb.com, also called "Fast" because it is incredibly speedy.

3) www.NorthernLight.com, with a special collection of valuable papers.

4) www.redesearch.com less known but highly intelligent.

5) Karnak.com a kind of Infinite Library which continues and updates the search.

6) www.infind.com which is so reliable.

7) www.meteor.com which started the very day I wrote this article. It is my task and pleasure to try new search engines and directories.

At this stage, we have already accumulated a few megabytes of "primitive" information. We know that the main categories of renewable energy are: Hydro, Solar, Wind, Biomass, Geothermal, Wave Energy; we have to add Hydrogen Energy (classical and Fuel Cells to these—given that these are also eco-friendly—that is they do not transfer much "bad" matter in the environment.) But note well: hydrogen *must* be produced by other energy sources. Thus, hydrogen, not considered as a "fuel" (as in cold fusion), is more properly a good means of energy *transport*. We can refine the search using these subcategories:

Books at www.amazon.com

Patents (US, EU, JP, WO at www.patents.ibm.com)

Papers at pubsci.osti.gov

Engineering issues at www.eevl.ac.uk

Discussion groups at www.deja.com or www.remark.com

Scientific news at www.sciencedaily.com,

www.scitechdaily.com, www.scicentral.com

You can search systematically for energy-related magazines, journals, and newsletters at many publishers; you will also discover that there are hundreds of organizations, companies, and associations dedicated to renewable energy news worldwide.

You also can get the names and addresses of the greatest specialists from the field. By virtue of the Pareto Law, the U.S. Department of Energy (DOE) stores and delivers the greatest part of the information. The result of your work of discovery and exploring will be a rather dense network of sites, which could be accessed from many "sides" and which is connected to other networks—as that of New Energy or the Fossil Fuels Network; the assembly is connected to sites more specialized in environmental issues or education, a fine fragment of the Internet.

You will discover the "stars" or "elite" websites, the best sources of information for renewable energy. My collection comprises:

a) CADDET, Centre for Analysis and Dissemination of Demonstrated Energy Technologies, based on multinational cooperation and aiming toward applicable processes and devices, with an energy efficiency branch and a renewable energy branch www.caddet-re.org.

b) NREL, National Renewable Energy Laboratory, the place where the most serious work is done www.nrel.gov.

c) EREN, Energy Efficiency and Renewable Energy Network www.eren.doe.gov.

d) CREST, Center for Renewable Energy and Sustainable Technology <www.solstice.crest.com>.

e) The SOURCE <www.rmii.com/theSource/renewableEnergy/>.

f) COMMONPURPOSE <www.vivid.com/corp/common/purpose> —my favorite node in this network, an environmental organization with an effective website.

g) REPP, Renewable Energy Policy Project, <www.repp.org>.

h) WREN, World Renewable Energy Network, <www.wrenuk.co.uk/home.html>.

i) New Renewable Energy Businesses <www.sourceguides.com/energy/new/html> with connections to hundreds of commercial sites.

j) The World Resources Institute <www.wri.org>.

k) Energy Information Administration <www.eia.doc.gov> and two on-line journals I read with great interest:

—Pulse, coming from the Oak Ridge National Laboratory <www.ornl.gov/new/pulse>.

—Energy Science News, edited by the Pacific Northwest National Laboratory <www.pnl.gov/energyscience>.

l) Renewable Energy Development Institute (Keith Rutledge's site) www.redinet.org.

You will have a vision of a huge effort of human and financial resources used for the development of renewable energy and will state that the results, measured as the contribution of this "good" energy to the global use, are surprisingly small. However, for the time being, the new sources of energy are just developing and will gain practical importance and weight only after many years. With the support of scientist and engineers coming from the neighboring energy fields, this will happen.

I have repeatedly stated in my industrial practice that there is no such beast as a final and total solution to the problem. It suffices for a solution to claim its uniqueness, to become immediately a part of the problem. Extending any solution proposed beyond its area or period of validity leads to failure.

A dynamic group of solutions is necessary for the energy problem, a synergy of different approaches. A transition era can be envisaged when fossil fuels, renewables, and new sources will coexist almost peacefully; and let the best win! For this reason, we hope to help our readers get a broader vision, with these conventional renewables included.

Reference

1. Yoda, S. and Ishihara, K. 1999. "The Advent of Battery Based Societies and the Global Environment in the 21st Century" *Journal of Power Sources*, 81-82, (1-2), 162-169. Also available online at <www.elsevier.com> for subscribers.

*Senior Consultant, Dynamic Network Technologies. Dr. Peter Glück is a chemical engineer with almost forty years of practice in research and a pioneer of the consulting activity in his country.
E-mail: Cluj, Romania <pgluck@dnctj.ro>



Wave Energy

Twenty thousand Brits are planning to create the world's longest ever Mexican wave by forming a continuous twelve-mile line across the Sussex countryside. This new category of record has been formally accepted by the Guinness Book of Records.

Power from the People

Clockwork radio and torch (flashlight) inventor, Trevor Bayliss, is busy working on his new system for collecting people power. His new Personal Power Company is investigating ways to generate sufficient electricity from walking to power portable devices. If a way can be found to harness the electrical charge given off from foot pressure alone, Bayliss hopes to use it to run a mobile phone, global positioning system, or emergency lighting. He is also developing electricity-generating roller blades which incorporate a dynamo or clockwork system and should give a whole new meaning to power skating.

—Soo Seddon

HAVE WE DISCOVERED THE

The "neno" is the acronym for an elusive particle which surprises us by feeding energy into our experiments as if from nowhere.

When New Zealander Dr. Robert Adams¹ claimed he had built a magnetic motor that could deliver power in excess of input, I questioned his method of measurement but had my own reasons, based on experiment, for being supportive. I suggested to him that he should run his machine in a calorimeter housing to get a measure of total energy output in heat form over a test period. This he has done, and he now affirms at least a 50% excess for his test machine.

However, there is nothing new in discovering a breach of the law of energy conservation. In the early part of this century, in 1914, a violation of the conservation law was reported in a German periodical² and this was later confirmed by other researchers who measured the heat generated in a calorimeter.³ They discovered that the heat generated was less (not more) than expected on the basis of the energy conservation principle and duly reported this, in 1927, in a prestigious U.K. periodical.³ Then, some six years later, in 1934, the puzzle was solved by imagining there to be a ghost-like particle which could be created and serve to carry the surplus energy off into outer space. The mystery particle has no mass and no electric charge, yet it has energy and an associated quantum of angular momentum.

Standard physics accepts this breach of the law of conservation of energy, because it thrives on the magical properties of exotic particle forms and presumably because it is easier to comprehend ideas which have little technical impact (loss of energy) than a counter-claim, of real technological impact, which says that there can be circumstances giving a gain of energy. So those who make those counter-claims tend to attract ridicule. Such is the state of a sleeping scientific world contented by dreams of virtual particles and pacified by the Einstein lullaby $E = Mc^2$.

So, I say to pioneers such as Robert Adams, Ken Shoulders, Paulo Correa, and Wingate Lambertson, combine in spirit and point the finger at the elusive ghost-like particle which I have named the "neno." By adopting this tactic you can justify a breach of the energy conservation law, simply by following the example of the 1934 precedent set by Fermi⁴ by his neutrino hypothesis in explaining Chadwick's discovery of the violation from testing the beta-ray spectrum, as later confirmed by the calorimeter experiments of Ellis and Wooster.³

Incidentally, the "neno" came first to mind as the "new energy news operator" but physicists are more likely to accept it if it stands for "negative energy neutrino operator," given that by producing it one creates a deficit energy state in the underlying quantum world of so-called empty space and, Hey Presto, Fermi's brainchild, the neutrino, comes along to bring spin and also that energy from nowhere.

References

1. Anderson, L. 1997. "Champion of Aether Energy: The Robert Adams Story," *Infinite Energy*, 3, 13/14, 5, Adams, R. 1999. "Update Edition of State of the Art of Applied Modern 20th Century Aether Science," personal communication to Harold Aspden, December.
2. Chadwick, J. 1914. *Verhand. Deut. Physik. Ges.*, 16, 383.
3. Ellis, C.D. and Wooster, W.A. 1927. *Proc. Roy. Soc.*, A117, 109.
4. Fermi, E. 1934. *Zeit. f. Phys.*, 88, 161.



Book Reviews

Voodoo Science: The Road from Foolishness to Fraud

by Robert L. Park

ISBN: 0-19-513516-6

\$25.00 Hardcover, 256 pp.

Oxford University Press

Tentative date for
publication is May 2000.

Review by Eugene F. Mallove

This review is of a pre-publication galley proof sent to *Infinite Energy* with a press release on Oxford University Press letterhead mocking cold fusion.

Historians of science may well look back on this book as a dying ember from the funeral pyre of late twentieth century establishment physics, which hurtles toward a supposed "theory of everything," while being blissfully ignorant of profound cracks in its very foundations. But author Robert L. Park, a physics professor at the University of Maryland, is now riding high. For some years he has been the darling of editors seeking crisp commentary from the chief representative of the American Physical Society (APS), a position he has held since 1982.

Whether railing against manned spaceflight, anti-ballistic missile defense, alternative health care, ESP research, UFO investigation, or his favorite whipping topic, cold fusion, you will find Robert Park in top mud-slinging form on the Op Ed pages of *The New York Times* and *The Washington Post*, among others. His politicized weekly "What's New" internet science column (www.opa.org/WN) is remarkable in that it is tolerated at all by the APS. Especially since Park, with insufferablechutzpa, ends each column with a fake disclaimer: "Opinions are the author's and are not necessarily shared by the APS, but they should be." That's pure Park, who hopes that his audience will come to see the world through the filter of the scientific certainties that he and many of his arrogant physics colleagues claim to possess.

Dr. Park has now compiled his wisdom in a short volume, in which he claims to have discovered a new kind of science—"voodoo science"—the title of his book. His definition of voodoo science is encapsulated in the subtitle, "The Road from Foolishness to Fraud." There is a progression from "honest error" that evolves "from self-delusion to fraud," he says. Further elaborating the definition: "The line between foolishness and fraud is thin. Because it is not always easy to tell when that line is crossed, I use the term *voodoo science* to cover them all: pathological science, junk science, pseudoscience, and fraudulent science."

This is how he says he discovered voodoo science. In the course of his PR work for the APS he "kept bumping up against scientific ideas and claims that are totally, indisputably, extravagantly wrong." He is that certain, three adverbs worth, that many of the things he calls voodoo science cannot be right. More often than not, he draws his conclusions from fundamental theory that is supposedly sacrosanct. Therein lies the fundamental failure of Park and so many of his colleagues in the physics establishment. They have abandoned what little curiosity about scientific experiments that they may have had at the beginning of their scientific careers: they attack data from experiments that at first glance appear to be in conflict with theory, about which they have concluded one of two things:

1) The theory can't possibly need fundamental modification, which might allow the phenomenon to occur or

2) It is inconceivable that existing theory can be applied to allow the phenomenon.

It takes a special kind of arrogance to conclude affirmatively on both those points, particularly when *both* experimental data and theory for an anomalous phenomenon trend strongly against the doubters, cold fusion being a prime example.

Park *thinks* he knows what he and the physics establishment are doing, but he does not. He writes, "...no matter how plausible a theory seems to be, experiment gets the final word." For Park, theory rules which experiments he will even look at. Revealing complete ignorance of the bloody battles over paradigm shifts in science (of the very kind he is obstructing!), Park claims, "When better information is available, science textbooks are re-written with hardly a backward glance." Baloney!

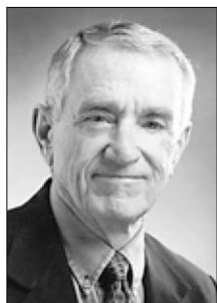
In *Voodoo*, Park dismisses cold fusion at its very first mention, referring to it as "the discredited 'cold fusion' claim made several years earlier by Stanley Pons and Martin Fleischmann." He says that a "dwindling band of believers" continue to gather each year "at some swank international resort" in an attempt to "resuscitate" cold fusion. He asks, "Why does this little band so fervently believe in something the rest of the scientific community rejected as fantasy years earlier?" He speculates later, "Perhaps many scientists found in cold fusion relief from boredom."

Park works himself up about cold fusion throughout the book and tells us what he *really* thinks of cold fusion: "On June 6, 1989, just seventy-five days after the Salt Lake City announcement, cold fusion had clearly crossed the line from foolishness to fraud." He states that Fleischmann and Pons "exaggerated or fabricated their evidence." (He only speculates whether cold fusion researcher Dr. James Patterson of Clean Energy Technologies, Inc. may have "crossed the line from foolishness to fraud.") He complains that no helium-4 results were forthcoming from Fleischmann and Pons by June 1989, ergo, cold fusion is a fraud. Since at least 1991, Park has been informed by fellow APS scientists, such as Dr. Scott Chubb, about helium-4 detection in cathodes and in the gas streams of cold fusion experiments. These independent experiments have been published in the U.S. and Japan in peer-reviewed journals. There is no doubt that Park knows this. *Voodoo* contains no mention of this data, an egregious fraud by Park on journalists and the general public.

Park has not troubled himself to study the very data which he demanded many years ago as proof of cold fusion, e.g. the helium-4 nuclear ash data, even after this data made it into the peer-reviewed literature. "You don't have to worry about the heat if there is no helium," was his statement to me in the spring of 1991, recorded in my book, *Fire from Ice*. On June 14, 1989, in the *Chronicle of Higher Education*, Park opined, "The most frustrating aspect of this controversy is that it could have been settled weeks ago. If fusion occurs at the level that the two scientists claim, then helium, the end product of fusion, must be present in the used palladium cathodes." Apart from his gross error of ignoring the helium that might be in the cover gas coming from surface reactions (such cold fusion helium *had* been detected in 1991 and later), it is notable that Park has never mentioned *any* of the published literature on helium in cold fusion experiments.

On the issue of cold fusion Park has traveled, in his lexicon, from foolishness to fraud. Though he has not troubled himself with inconvenient facts, such as experimental evidence of robust character that supports cold fusion, he states preposterously: "Ten years after the announcement of cold fusion, results are no more persuasive than those in the first weeks." He rewrites cold fusion history with ludicrous bloopers designed to entertain: "How, I

Courtesy of Oxford University Press
Photo by Chad Evans Wyatt



wondered, could Pons and Fleischmann have been working on their cold fusion idea for five years, as they claimed, without going to the library to find out what was already known about hydrogen in metals?" Electrochemist Fellow of the Royal Society Martin Fleischmann not knowing a lot about hydrogen in metals? A bit much to suggest, even for an unethical obfuscator like Park. Park is the one who should have gone to the library. He would have discovered that leading cold fusion scientists like Fleischmann and Bockris wrote the textbooks about hydrogen in metals. Fleischmann's outstanding research in this area earned him a Fellowship in the Royal Society, arguably the world's most prestigious scientific society. In other contexts Park claims allegiance to established theory and the expertise of leading authorities; in this case, he does not even realize who the authorities are.

If Park doesn't get his information about cold fusion from technical papers, the normal approach in science, from where does he get it? Apparently he is briefed by fact-resistant critic Dr. Douglas Morrison of CERN, who has attended the international cold fusion conferences where he asks mostly obtuse questions, proving that he, like Park, has not read the cold fusion literature. Morrison has "kept an eye on cold fusion for the rest of us," as Park puts it. The result of all this is to have Morrison, the prime purveyor of the "pathological science" theory of cold fusion, passing misinformation to Park, who then jazzes it up with snide remarks suited to the Washington beltway crowd.

Morrison is the only skeptic to actually publish a paper that attempts to come to grips with quantitative issues of cold fusion calorimetry and electrochemistry. Every paragraph in his paper included an elementary mistake. A few examples: he subtracted the same factor twice. He claimed that Fleischmann and Pons used "a complicated non-linear regression analysis" method—which they did not use. He recommended another method instead—the one, in fact, they did use. He confused power (watts) with energy (joules). He claimed that hydrogen escaping from a 0.0044 mole palladium hydride might produce 144 watts of power and 1.1 million joules of energy, whereas the textbooks say the maximum power from this would be 0.005 watts, and a simple calculation shows that the most energy it could produce is 650 joules. This is the "expert" Park relies upon for news of cold fusion!

And Park well knows the propaganda value of turning a serious subject into a joke. In his account of the early days of cold fusion he observes, "Cold Fusion was becoming a joke. In Washington that is usually fatal."

After assailing the main body of cold fusion research, Park singles out for attack Dr. Randell Mills of BlackLight Power Inc. (see *Infinite Energy* coverage, Issue No. 17 pp. 21-35 and Issue No. 29, pp. 40-41). He says that Mills did not offer "any experimental evidence" for his claims of excess energy caused by catalytic hydrino formation. Park does not discuss the multiple channels of experimental and astrophysical data that Mills has cited to defend his theory. He covers up the serious, positive results that the NASA Lewis Research Center published in its official report on the Mills replication. But Park, at his core, argues mainly from theory: "But those who bet on hydrinos are betting against the most firmly established and successful laws of physics." Mr. Certain asks rhetorically, "What are the odds that Randall [sic] Mills is right? To within a very high degree of accuracy, the odds are zero."

Though I expected Park to bash scientific anomalies, I was unprepared to discover the depths of his ignorance about spaceflight and its future. Commenting on his early 1990s testimony before Congress in support of unmanned space missions, he recalls, "I wanted to explain why the era of human space exploration had ended twenty-five-years earlier and was

unlikely ever to come back." No future for human presence in space? Is Park for real? He ends his myopic refrain with inept poetry bearing an absurd message, "America's astronauts have been left stranded in low-earth orbit, like passengers waiting beside an abandoned stretch of track for a train that will never come, bypassed by the advance of science."

Amateur astronaut Park offers an amazing blooper, "If there was gold in low earth orbit, it would not pay to get it." Astonishing! He apparently does not understand such elementary concepts as the small propulsion energy cost of de-orbiting with rockets and aero-braking, when he makes this and other claims. In the emerging era of commercial space transportation, this Park *faux pas* will be remembered as a late twentieth century howler, on par with statements by astronomer Simon Newcomb earlier in the century that heavier than air flight was likely to remain impossible.

In Park's crusade against manned spaceflight, he even goes after astronaut hero John Glenn: "Both Ham [a chimpanzee aboard an early U.S. space flight] and Glenn would end up in Washington: Glenn in the U.S. Senate, Ham in the national zoo. Ham died a short time later without ever returning to space." He attacks "messianic engineer," Robert Zubrin, who has put forth concrete, well-researched proposals for cost-saving space missions, in his book *The Case for Mars*. Park says that Zubrin started "his own cult—the Mars Society." Park mocks the aspirations that led people like Dr. Robert Goddard and so many others this century to work toward the manned exploration of space: "Zubrin had learned his lessons well. The focus is on the dream. His followers feel their feet crunching into the sands of Mars, while the most daunting technical challenges are swept aside with simplistic solutions."

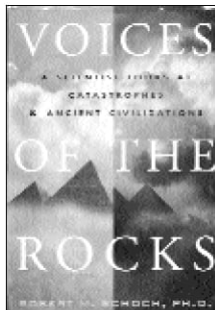
On the book jacket Park singles out "magnet therapy" and cold fusion as the epitome of "foolish and fraudulent scientific claims." In the only "experiment" that he actually decides to personally conduct to test any of his opinions, he launches a misguided effort to disprove the alleged therapeutic effectiveness of magnets in contact with the human body. He bought some athletic magnets from a local store, then stuck one on a steel file cabinet. He then inserted sheets of paper under the magnet, finding that at ten sheets the magnet fell off. He exults, "Credit cards and pregnant women are safe! The field of these magnets would hardly extend through the skin, much less penetrate muscles." Park had merely found the point at which static friction (caused by the magnetic force) is insufficient to hold the magnet against the force of gravity. On this basis he concludes that magnetic field would not penetrate into skin! This is completely wrong, as sophomore physics students at MIT, and presumably at the University of Maryland, would know. Park gets an F-grade on that one. "Not that it would make any difference if it did penetrate," he says. Park always has some *a priori* theoretical insight about why something "can't be." This PR agent for the American Physical Society needs a refresher course in Science 101.

Given Park's incompetent assessment of cold fusion and his failures in elementary scientific methodology, we cannot expect a useful appraisal of other controversial areas, such as whether or not there are loopholes in or extensions to classical thermodynamics, whether low-level electromagnetic fields can affect biological systems, the "memory of water" question, or the scientific foundations of alternative medicine. Regardless of their individual merits, Park gives these questions the same brush-off he applies to cold fusion. It is not that one might never find areas of agreement with Park. For example, some of the charlatan-like antics of Dennis Lee of Better World Technologies, which Park chronicles, are

Voodoo continued on page 68

**Voices of the Rocks :
A Scientist Looks at
Catastrophes and
Ancient Civilizations**

by Robert M. Schoch
ISBN 0-609-60369-8
\$25.00 Hardcover, 256 pp.
Harmony Books, 1999



Review by Soo Seddon

Yet another scientist looking at catastrophes and ancient civilizations (and publishing just long enough before the ominous Y2K deadline to generate ripples of pre-millennial paranoia) was, I admit, my first thought on seeing this title. An unjustified reaction, as it turned out.

It's true that Schoch is a scientist but, as I once heard a pompous Professor of Physics sneeringly say, "only a Geologist." It is also true that a perusal of the index will reveal "Atlantis, lost city of" and "Mars, face on" but don't let that put you off. This is a fascinating book and well worth reading. An intriguing mix of myth and math, written in a style that's highly entertaining once you get the hang of it.

Schoch's credibility starts to establish itself right in the first chapter, "The Changing of the Paradigm," where he states that the conventional (as taught in high school) view of how scientific ideas only hold sway until refuted by challenging anomalies which must, inevitably, lead to the questioning and eventual abandonment of previously rock-solid theories, is "orderly, intellectual, and polite. It is also wrong." He goes on to recommend a reading of Kuhn's *Structure of Scientific Revolutions* for those who want to know how science really works.

He had personal experience of how jealously a prevailing paradigm is guarded. After presenting a paper to the Geological Society of America suggesting a much earlier date for the building of the Sphinx of Giza than that generally accepted, the venomous outpourings of hordes of angry Egyptologists were instantly directed towards him.

He stands by his results, gained from extensive seismic testing and painstaking examination of the weathering patterns on the ancient structure, which convinced him that several millennia separate the construction date of the Sphinx from that of the surrounding pyramids. Those Egyptologists, he says, "were defending their own dogma rather than examining the evidence with the dispassion it deserves."

Schoch's book is a relaxed, non-sensationalist work. His presentations and analyses are calmly done in a truly scientific and objective manner which is unusual considering the subject matter.

He is scathing of non-scientists (even non-geologists) like Graham Hancock and Robert Bauval for being "too eager to inflate problems into mysteries and puff interesting insights into revolutionary findings that are nothing of the sort." Bizarrely, both those authors offer up effusive praise for his work on the back of the dust jacket!

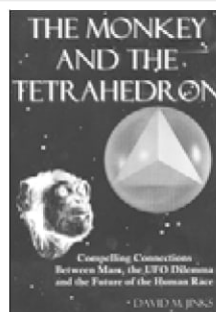
In the last few chapters, Schoch pulls it all together. After a fascinating whirlwind tour of ancient sites and in-depth examination of ancient beliefs, each given a fair hearing and then equally fairly set aside on the grounds of dubious provenance, he finally declares his ultimate conclusion.

By combining his geological expertise with some heavy-weight historical and cosmological statistics, he concludes that

Voices continued on page 68

**The Monkey and
the Tetrahedron**

by David M. Jinks
ISBN 0-9667258-0-8
\$22.95 Hardcover, 476 pp.
Glass Moon Press, 1999



Review by Jeremy Jones

Are you a believer? What exactly do you believe in? Do you worship a single God in Heaven or do you know in your heart that your ancestors swung down from the trees eons ago? Or maybe you're like me, somewhere in between. Well, if you are like me and you intend to sit down with this book, then you're probably pretty safe. But, if you have your belief system set strong in your soul, prepare to be shaken to your very core. Everything you think you "know" will not only be laid on the dissecting table, it will subsequently get thrown off that table by a presentation of astonishing facts that are as

close to indisputable as anything this reader has ever seen.

The main purpose of David Jinks' endeavor is to cite some incredibly intriguing case studies on a variety of controversial subjects and then find some possible connections among them. The long-debated Cydonia region of Mars, the new hydrogen energy phenomena ("cold fusion"), ancient civilizations, UFOs, crop circles, and government conspiracies are all thoroughly examined subject-by-subject and then pulled together so that their commonalities can be compared and analyzed. The result is akin to a giant fishnet being reeled from the ocean, where the ropes are the steadfast facts being uncovered, but the meaning of it all slips through like the waves of the sea.

Mathematical and geometrical calculations are the core of this book (as they may prove to be the very core of our existence). These are not, however, presented in an insanely complex manner, so even a decently educated layperson can understand the significance of what they suggest. I personally was a little doubtful when the theory of hyperdimensional physics was called in to help explain some of the "impossibilities" uncovered by the various research results. An open mind will always understand that time will tell if such a theory can be substantiated.

My only negatives about this book came at the end chapters, where the writing became deeply philosophical and turned from hard scientific study into the sort of exposition I would expect from Buddha or the Dalai Lama. Jinks certainly raises some questions with his writing at this point, but I felt that it detracted from the overall attention-grabbing quality of the rest of the book.

If you have an interest in any of the topics mentioned above, then you will want to read this book. Very well-written, very well-organized, and definitely a good addition to this reader's library, *The Monkey and the Tetrahedron* will astonish you by showing how so many obvious links to our past were so grossly mishandled.

□□□

Editor's Note: Jeremy Jones is a young and able "Renaissance Man," who works at Lighthouse Press—the company that prints *Infinite Energy*—in Manchester, New Hampshire. He has a keen interest in our magazine and the field. —EFM

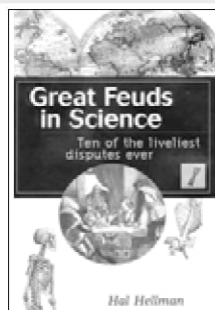
Great Feuds in Science

by Hal Hellman

ISBN 0-471-16980-3

\$24.95 Hardcover, 240 pp.

John Wiley & Sons, 1998



Review by Thomas E. Phipps, Jr.

There has never been any substantial progress in science without controversy. This may be an empty observation because "progress" is not clearly definable nor finally defined. For example, my personal view of most of the landmarks of fundamental physics during the past half-century, such as quarks, gluons, black holes, Big Bang, etc., is that they are not progress but sweeping (and possibly fatal) digressions from the main pathway of evolution of a sound discipline. That is, like the "physics" of epicycles, they are backwaters in which whole

generations of physicists spend their time—perhaps millennia of time—doing little more than impressing each other with advanced mathematics and earning a living. Now that physics has become a full-fledged profession, its academic practitioners tend to differ from a dogmatic priesthood only in that they work harder with fewer visible benefits to society. Perhaps this is why young people seem less attracted to the field these days. It is just as hard to fake progress as to define it. . . and fifty years of fundamental non-progress, hyped to the skies, creates an odor that any virgin nose can hardly mistake.

The book under review deals with ten historical examples of controversy in various sciences. They have been chosen by the "internationally acclaimed author of twenty-six popular science books," I suppose, for their "human interest," as well as for their cruciality for science progress, as judged from the modern viewpoint. Wisely, the physics of this century has been omitted. Instead, we are taken back to Galileo versus the Church, Newton versus Leibniz, etc., as well as struggles on other more recent scientific battlefields, such as Darwin's defenders versus his detractors, Wegener versus detractors, Margaret Mead versus detractors, etc. Already, in the case of this last, one can see ideology beginning to encroach on science or to dictate its "politics." This seems to occur as an inverse measure of the genuinely scientific content of a controversy. (It is debatable, *e.g.*, in such matters as "global warming," whether ideology flies into, or whether it creates, a vacuum of science.)

Is it germane to the modern condition for us to study past controversies? There is, of course, the (Santillana) adage that those who ignore history are condemned to repeat it. . . but what kind of history? There is so much of it. As I hinted above, it might be more relevant to study the history of priesthoods; or, within science itself, to seek parallels between the personality, methods, and followers of Claudius Ptolemy, who ruled a millennium past, and Albert Einstein, who will rule the one to come. . . each in his era (can it be doubted?) to the detriment of

... "Galileo's opponents had been academics" of the sort who declined to look through his telescope and who "when all else failed. . . decided to throw the church at him." Does this sound a bit like today's academics, who do not hesitate to throw government committees at their enemies?

scientific progress. But the author of twenty-six popular science books can hardly afford to present a publisher like Wiley with an unpopular one.

If a) I am wrong in my pessimism and b) no fundamental change of conditions or attitudes distinguishes the historical period covered by this book from the period just ahead, then it will indeed pay us to study these past controversies or "feuds" with close attention. . . for they will be sure to teach us much that we can use. The author has done what I (who am no historian of science and thus not qualified to judge) presume to be a very competent job. He has avoided the standard "scholarly" prose traps of jargon-loaded and over-footnoted text. (There are footnotes, but they are judiciously quarantined as chapter-related endnotes and bibliography.) Even if there are shortcomings of scholarship, which almost has to be the case of any popularized exposition, these should not much detract from, and may enhance, the accessibility of any messages. (My ideal in this respect is Gibbon, who I am sure must infuriate more conservative students of Roman history through his willingness to enhance the usefulness of his material to the ordinary reader by passing value judgments and deducing "lessons." Even where *facts* speak for themselves they tend to stammer. . . a bit of eloquence in their behalf can do no harm.)

So, what are the lively messages conveyed by this author's examination of "ten of the liveliest disputes ever"? Actually, messages that we can put directly to use in our own day seem to be rather sparse on the ground. The thread of human frailty runs through all cases, of course—and the feet of clay—but that we surely knew, even without history to tell us. And what is there to *do* about human attributes, given that eugenics nowadays is politically incorrect? There is, in fact, nothing to do about frailty except to avoid being surprised by it. Perhaps this book may help some innocents in that respect.

More seriously, one wonders if secular changes in the basic human condition on earth, as by inexorable crowding of the population, including that of "scientists," have altered the conditions for acquisition of "new knowledge". . . so that not only new players appear but a new game as well. Perhaps prosperity and the defining of "progress" will reward in the future not the mice who read history but the rats who reinvent it. (Forgive a grim thought for the new millennium, which may shape up as a sort of jazz version of the Dark Age.) In the past, scientific progress has been wrought by the strong individual who stood up against the tide of false knowledge (dogma). But perhaps that tide, that consensus, through sheer weight of numbers now grows too strong to be breasted by any individual, no matter how heroic—so that effectuation of change requires the agreement of committees. In that case we face the ultimate democratization, the heat death of science, the Millennium of Contending Dogmata—wherein the heroes are "schools of thought," no idea is accorded any merit beyond the nose-count of its supporters, and "progress" is solely from fad to fad.

Paradoxically, the most telling lessons of this book seem to be deducible from the older examples, particularly Galileo versus the Church. Several subtleties are brought out by the author (following Santillana), such as that originally "Galileo's opponents had been academics" of the sort who declined to look through his telescope and who "when all else failed. . . decided to throw the church at him." Does this sound a bit like today's academics, who do not hesitate to throw government committees at their enemies? The more the power game changes the more it is the

Feuds continued on page 68

Sir J.J. Thomson, Transmutation, and the Ether

Paul E. Rowe*

Introduction

Prior to 1930, many respected scientists (including members of the Royal Society of London) reported the appearance of helium and neon in very high voltage tubes.¹ This paper includes direct quotes from Nobel laureate Sir J.J. Thomson, Cavendish Professor at Cambridge University. Thomson, a renowned experimenter known as the discoverer of the electron, reported the appearance of helium and neon after bombarding various salts (in vacuum) with cathode rays. He suspected that the gases might have been the result of transmutation.²

In a 1996 paper,³ I attempted to demonstrate that hydrogen gas has been produced in and from vacuum. The paper included direct quotes from many highly respected experimenters, along with results of my own experiments. In subsequent papers,^{4,5,6} I proposed that vacuum may not be void but a rather highly concentrated matrix of protons and electrons and suggested that the matrix might be Bose-Einstein condensed hydrogen. In the present paper, I will attempt to show that the presence of such a matrix is not as unlikely as it seems and that neutrons produced in or from such a matrix might cause transmutation while avoiding the Coulomb barrier. In the process, I will discuss physical phenomena that many scientists have forgotten that they can't explain.

Production of Helium and Neon in Vacuum

In a 1996 paper,¹ I quoted many experimenters who believed that they had produced helium and/or neon in electrical discharge experiments. The following three quotes are from Sir J.J. Thomson,² who bombarded various materials with cathode rays:

To test whether this was the source of helium I bombarded soluble salts such as LiCl, NaCl, KCl, KI, RbCl, AgNO₃ which were dissolved in water and also in some cases in alcohol and then evaporated to dryness. The process being repeated several times. Salts which had been treated in this way yielded helium and in some cases neon; the yield of helium from the salts of the alkali metals and in particular from potassium was exceptionally large, KI giving a larger supply than any other of the substances I examined, with the exception of those like monazite sand which are known to contain large supplies of helium. Some of the salts have yielded apparently undiminished supplies of helium, after being dissolved and evaporated ten to twelve times.

The aluminum cathode in the tube used to bombard the substances with cathode rays might be suspected as a source of helium. If this were the case, however, the rate of production of helium would not depend upon the nature of the salt bombarded, nor would it make any difference as to whether the cathode rays hit the salt or not. As both these conditions have a great influence on the rate of production of helium we may regard this source as eliminated. In addition to the preceding considerations some of the cathodes have been in almost continuous use for months without any perceptible diminution in the rate of supply of helium.

The view that helium can be got from other elements raises questions of such a fundamental character that few will be prepared to accept it until every other explanation has been shown untenable. It would greatly strengthen the proof if we could detect the parts of the atom which remain when helium is split off.



J.J. Thomson from *Harper's Monthly*, 1904.

Many experimenters, using modern techniques, have reported detecting such "split-off" parts.⁷

Thomson believed that his experiments involved a stream of electrons bombarding chemical compounds and wondered whether such bombardment could cause transmutation. It seemed unlikely, since the electrons weren't expected to reach a nucleus because of the Coulomb barrier. If neutrons were somehow produced in his apparatus, Thomson's observations are as expected.

Production of Hydrogen in Low Pressure Helium

In a 1905 paper, Clarence Skinner⁸ of the University of Nebraska reported the appearance of hydrogen gas during the passage of electricity through a discharge tube containing low pressure pure helium (2 torr.). The DC voltage across two electrodes inside a helium-filled glass tube was increased until a current of two milliamps passed through the tube. As the discharge proceeded, Skinner adjusted the voltage to keep the amperage constant. The following quotes are from his paper:

... it was observed that no matter how carefully the gas was purified the hydrogen radiation, tested spectroscopically, persistently appeared in the cathode glow. Simultaneous with this appearance there was also a continuous increase in the gas pressure with the time of discharge.

Skinner then gave evidence that the hydrogen was produced at the cathode; just as it is produced at the cathode in the electrolysis of water. He pointed out that the initial rate of hydrogen production was that predicted by Faraday's law of electrolysis. The quantity of hydrogen produced at a silver cathode was particularly surprising:

With a freshly polished metal as cathode the gas pressure increases at first at a constant rate, but after a time this rate begins to drop off until the pressure appears to have reached a constant maximum value. Silver was depleted in this way giving off about two-tenths of a cubic centimeter (measured at atmospheric pressure) of hydrogen. The current was then broken and the hydrogen absorbed by the Na, K cathode. After standing in helium over night and then tested again the next morning it was found to have a new supply equal to the one given up the day before. Without allowing it any chance of regaining hydrogen from an external source it was thus depleted six or eight times during the course of two weeks and found to give off at each time about the same amount of gas. With a few hours rest, only a slight recovery was noticed.

After this series the silver was removed from the tube, re-polished, and then tested again with the same results. Altogether

about two cubic centimeters of gas had been given off by this silver disk, which is fifteen millimeters in diameter and about one millimeter thick. It shows no sign of having its supply of hydrogen reduced in the least.

The volume of Skinner's silver cathode was about 0.177 cc. He obtained 11.2 times this volume (at standard temperature and pressure) of hydrogen. In 1928, E.W.R. Stearcie and F.M.G. Johnson⁹ of McGill University reported on an exhaustive study of the solubility of hydrogen in silver. They found the solubility increased with temperature and with the pressure of hydrogen. At 400°C and a hydrogen pressure of slightly over one atmosphere, silver absorbed 0.007 volumes (at standard temperature and pressure) of hydrogen. Skinner obtained 1600 times as much hydrogen from his cathode which, "shows no sign of having it's supply of hydrogen reduced in the least."

Certainly, the hydrogen which Skinner produced did not come from the silver, which had been stored in air and then under vacuum, at room temperature.

Skinner noted that his cathodes became tarnished during discharge and that cathodes which remained tarnished on standing did not "recover their supply of hydrogen." Metals, like silver, whose tarnish "dusted off" on standing did recover their supply. If atomic hydrogen were produced at the cathode by electrolysis of the matrix, it would be expected to react with the surface of the cathode to form a hydride. If the hydride was stable, the surface would retain its hydride coat. Silver forms an unstable hydride which decomposes into silver and hydrogen gas. Overnight, the silver powder which formed might be expected to dust off, leaving a fresh silver surface on the cathode.

Skinner performed many different experiments and reported many unexpected results. All of them can be readily explained, if one assumes that atomic hydrogen is produced at the cathode surface, two hydrogen atoms combine to form diatomic hydrogen which, in turn, combines with atomic hydrogen to form tri-atomic hydrogen, and that tri-atomic hydrogen carries the current through the discharge tube at a lower voltage than is required to produce hydrogen from the vacuum. A steady current would be achieved at a voltage where the tri-atomic hydrogen was produced at the same rate as it decomposed into hydrogen.

In 1913, Thomson¹⁰ reported finding a positive ion having an atomic weight of three in his discharge tubes. Whenever it was found, hydrogen was also present. He suggested that it might be tri-atomic hydrogen which had lost an electron.

In 1920, G.L. Wendt and R.S. Landauer¹¹ of the University of Chicago produced tri-atomic hydrogen in a hydrogen filled discharge tube and determined its properties. They found that it was very reactive and quite unstable. It decomposed into diatomic hydrogen in about a minute. I believe that its properties are compatible with the above explanation of Skinner's results.

In order to retain a current of two milliamps, Skinner had to keep reducing the voltage across his electrodes. In similar experiments, I have found that once a steady discharge is achieved and then purposely stopped, the voltage at which the discharge will restart is a function of the time between discharges. If the discharge is restarted almost immediately, it will restart at a voltage very close to that at which it stopped. If the delay is one minute, the discharge will start at a much higher voltage. If the delay is over two minutes, a still higher voltage is required to initiate discharge. This is consistent with the mechanism proposed above. That is, as the tri-atomic hydrogen concentration reduces with time, the voltage required to reinitiate discharge increases greatly. Other techniques for producing hydrogen from vacuum are described in my previous papers.^{3,4,5}

Maxwell's Equations

Maxwell's equations quite accurately predict the speed of light in various media and the reflectivity of light at media interfaces. In order to make these equations work, Maxwell had to give vacuum a definite dielectric constant and a definite magnetic permeability. Can a void have such properties?

Dielectric Constant

The simplest capacitor is made up of two metal plates separated by a dielectric medium. The relative dielectric constant of the medium is the quantity of charge it will store at a given voltage divided by the quantity of charge it would store if the medium were vacuum. The actual dielectric constant (ϵ) is the relative dielectric constant (k') times the dielectric constant of vacuum (ϵ_0) or:

$$\text{dielectric constant } (\epsilon) = k' * \epsilon_0$$

If the dielectric constant of vacuum (ϵ_0) was zero, the dielectric constant of anything else would be zero.

Note the similarity to specific gravity, which is the density of a material divided by the density of water. This would be meaningless if the density of water was zero.

The mechanism by which a dielectric stores charge is believed to be as follows: As the voltage across the capacitor increases, some negative charges in the dielectric are pulled toward the positively charged plate and some positively charged particles are pulled toward the negative plate. The greater the voltage drop, the greater the electrical distortion, and the greater the amount of charge that can be stored in the capacitor. Since a vacuum filled capacitor stores charge, vacuum likely contains positive and negative charges.

Magnetic Permeability

The permeability of a magnetic material is usually associated with the unpaired electrons it contains. Since vacuum has a permeability, it, very likely, contains unpaired electrons. Physics does not have a satisfactory explanation for the forces you feel while playing with two bar magnets (one in each hand). The explanation is quite simple, if one accepts that there is a matrix containing unpaired electrons between the magnets.

Vacuum

The above suggests that vacuum contains unpaired electrons and positive particles. The "Production of Hydrogen in Low Pressure Helium" section (above) includes evidence that hydrogen has been produced in and from vacuum. This is not surprising if vacuum is a concentrated matrix of protons and electrons.

Most of the great scientists of the past believed in a matrix (the ether) which fills space and accounts for forces of gravity and magnetism (action at a distance). Could this ether be the matrix of protons and electrons that I have proposed? Since protons and electrons have mass, the matrix fills the requirements for the dark matter scientists require to account for the stability of galaxies.

The portion of such a matrix in the vicinity of the Earth would be expected to move with the Earth, as does all mass in the vicinity of the Earth. This accounts for the observations of Michelson and Morley. It also leads to a simple explanation of stellar aberration.

If the matrix is also the vehicle for the transmission of electromagnetic energy, the matrix must fill the knowable universe.

The Neutron

The reader will consider this paper to be highly speculative. The rest of the paper may be considered to be guesses. Anyone who wishes to submit alternate suggestions is welcome to do so.

The helium nucleus, which is made up of two protons and two

neutrons, is much more dense than the proposed ether, which I suggest is a matrix of effectively touching protons and electrons. If one pictures protons, electrons, and neutrons as hard spheres, these statements are extremely difficult to reconcile. If, however, one pictures the ether particles as disks or rings, which are spinning in such a way as to sweep out spherical volumes, the statements are compatible. The higher density of the helium nucleus could result from most or all of this spin being overcome by the mutual attraction of the particles, resulting in a great volume reduction and the evolution of large quantities of energy.

A free neutron decays into a proton and an electron and (theoretically) an antineutrino. The half-life of the decay is about 12 minutes.¹² A neutron in the helium nucleus is stable indefinitely. A neutron is typically absorbed in less than 10^{-3} seconds when passing through materials.¹² This suggests that there is a great difference between the neutron in the nucleus and the neutron in space.

It is tempting to consider that, under the proper conditions, neutrons could be produced in the presence of ether protons and electrons. If so, Thomson's observations suggest that the potassium ion may be an excellent catalyst for the combination. In a recent patent, Randell Mills¹³ claims that potassium is the preferred catalyst for converting hydrogen atoms to lower energy states (hydrinos) than what is considered the ground state. He considers the hydrinos to be much smaller than hydrogen atoms. Is the selection of potassium as the preferred catalyst in both cases a coincidence? Perhaps Thomson converted ether particles into hydrinos and then into a lower energy form of the neutron.

The proton and electron of a neutron produced in this way may have lost much of their spin, and the neutron may be smaller and much less energetic than the free neutron, which has a half-life of about 12 minutes.

The mass of a free neutron is 1.67482×10^{-27} kilograms and the mass of a hydrogen atom is 1.67343×10^{-27} kilograms. If each is made up of a proton and electron, proper addition of energy might be expected to convert a hydrogen atom or any proton-electron combination into a neutron. However, the difference in mass means that an extremely large quantity of energy would be required. If catalysis permits production of a much lower energy and smaller neutron, much less energy would be required. If the neutron produced is small enough, energy would be evolved. In any case, such a catalytic effect may permit formation of neutrons and, therefore, transmutation under surprisingly mild conditions.

Summary

Results reported by many highly respected experimenters suggest that hydrogen gas has been produced from vacuum. Clarence Skinner reported that hydrogen was produced at the cathode of a helium-filled electrical discharge tube and pointed out that the initial rate of hydrogen production was that predicted by Faraday's law of electrolysis. He used several metals as cathodes and noted that the cathodes tarnished during discharge. I believe that the tarnish was metal hydride formed by reaction with atomic hydrogen produced at the cathode by electrolysis of a matrix of protons and electrons which fills vacuum. If so, vacuum is not a void.

Could this matrix be the ether postulated by many great scientists of the past? The existence of such an ether leads to simple explanations of many phenomena which have not been adequately explained.

Results reported by many experimenters indicate that controlled transmutations have been produced under surprisingly mild conditions. Thomson produced helium and neon by bombarding salts with cathode rays. He found that potassium salts

were particularly fruitful in producing these gases and suggested that the gases might have been the result of transmutations.

The potassium atom and/or ion may be a particularly good catalyst for the production of low-energy neutrons from protons and electrons. Such neutrons, on being absorbed by atomic nuclei, would be expected to initiate transmutation.

References

1. Rowe, P. 1996. "Controlled Transmutation of Elements Under Surprisingly Mild Conditions," *Infinite Energy*, 2, 8, 30-31.
2. Thomson, J.J. 1988. *Rays of Positive Electricity and Their Application to Chemical Analysis*, (Reprint by Borderland Sciences, P.O. Box 429, Garberville, CA 95440).
3. Rowe, P. 1996. "Hydrogen Gas from Vacuum, Part I," *J. of New Energy*, 1, 2, Summer, 108-111.
4. *Ibid.*, pp. 112-115.
5. Rowe, P. 1997-1998. "Hydrogen from Vacuum," "A Brief History of the Ether," and "Time, Mass and Velocity," *Infinite Energy*, 3, 17, 80-85.
6. Rowe, P. 1998. "Hydrogen Gas from Vacuum, Part III," *Infinite Energy*, 4, 20, 73-77.
7. Rowe, P. 1997-1998. "The Possible Source of Energy for Anomalous Effects Reported in Infinite Energy," *Infinite Energy*, 3, 17, 79.
8. Skinner, C. 1905-1909. "The Evolution of Hydrogen from the Cathode and Its Absorption by the Anode in Gases," *Phys. Rev.*, 21, 1-15.
9. Stearcie, E.W.R. and Johnson, F.M.G. 1928. "The Solubility of Hydrogen in Silver," *Proc. Roy. Soc. London, A*, 117, 662-79.
10. Thomson, J.J. 1913. "Some Further Applications of the Method of Positive Rays," *Nature*, 91, 333-337.
11. Wendt, G.L. and Landauer, R.S. 1920. "Experimental Attempts to Decompose Tungsten at High Temperatures," *J.A.C.S.*, 42, 930-946.
12. Weidner, R.T. and Sells, R.L. 1968. *Elementary Modern Physics*, Allyn and Bacon, Inc., Boston, MA, 415.
13. Reproduced in 1997-1998. *Infinite Energy*, 3, 17, 67-71.

About the Author

Paul E. Rowe has a B.S. degree in chemistry from MIT and a Ph.D. degree in physical organic chemistry from Boston University. For six years he was a Project Chemist at the National Northern Division of the American Potash Company in Hanover, Massachusetts, where he helped develop explosive and propellant mixtures, primarily for military use.

For twenty-one years he worked at the Emerson & Cuming Division of W.R. Grace Company. He helped develop various new products in the dielectric materials fields. These included radar absorbers; lenses and reflectors; and plastic, glass, and ceramic dielectrics. He also assisted in developing deep water flotation for offshore exploration. In 1980 he retired as Director of Research and Development and became a consultant in these fields.

*71 West Way, Mashpee, Massachusetts 02649;
e-mail: 111627@cs.com

Space Energy

Space may be teeming with untapped energy but whether you get positive or negative output is all a question of how it's arranged.

Some UK housebuyers are refusing to complete a property purchase until they've had a full Feng Shui survey. If the results gained by dowsing for geopathic stresses reveal a negative energy flow, the deal's off.

Feng Shui consultants charge around \$600 to draw up a floor plan identifying the areas of good, or bad, vibrations.

Traditional property surveyors are in despair. They are used to pointing out and advising upon ordinary structural defects, but are at a loss when their clients reprimand them for failing to discover that the house karma is all wrong because the front door faces the wrong way.

—Soo Seddon

Effects of Planetary Positions on Transatlantic Radio Propagation: A Fifty-Year-Old Discovery Re-visited

Compiled by Don C. Maier*

Almost fifty years ago I had the pleasure of meeting Mr. John H. Nelson, who worked for the RCA Communications Company in New York City. At that time I was a pilot and Communications Officer in the U.S. Air Force, and was in New York with a group of U.S.A.F. Officers to learn about large scale communications systems. John was one of our instructors.

In those years the only practical way to communicate across the Atlantic was by cable teletype (slow, single channel) or by short-wave radio. Multiplex teletype systems were being developed in an effort to speed things up on the latter medium. The biggest problem was periodic total loss of signals due to variations in the Heaviside Layer. This is an ionized area of the upper atmosphere which reflects short-wave signals back to earth, and is the main reason that round-the-earth communications were possible at all. But various forms of radiation from outer space, mostly emanating from our Sun, affect both the altitude and the reflecting efficiency of this layer.

RCA Communications had a network of short-wave transmitters and receivers located out on the eastern end of Long Island. Their antennas were huge arrays that were aimed at Europe and North Africa. Over the years they kept an accurate log which listed times when the signals were especially good, routine, poor, or non-existent.

It happened that John was an amateur astronomer; he had his telescope installed on the roof of the RCA Building. This was before the smog problem made seeing next to impossible. John was mainly interested in watching the Sun to get data on location, size, and density of Sunspots. Through consulting his astronomical charts over the years, he discovered a fascinating series of relationships between the positions of the planets, the number of sunspots, and the quality of the transatlantic signals as reflected in the radio log records.

When the planets were situated around the Sun in a random orientation, the logs showed average to good conditions fairly consistently. But when some of the planets (especially the major ones) were in a 90° relationship to each other, poor to non-existent signal conditions would manifest. Conversely, when there were 120° relationships among some of the planets the signal conditions were good to excellent. Soon John had sufficient confidence in his observations that he could predict when good and bad conditions would occur, and he submitted a paper on the subject which was published in the *RCA Review*. He gave me a copy of that document, which I have treasured over the years. This is something that I think needs to be preserved.

It appears from John's data that various activities in and at the visible surface of the Sun are influenced by gravitational or some other (unknown) stresses produced by the planets, which in turn produce electromagnetic and "solar wind" phenomena that are felt here on our planet. At the present time our communications satellites have largely replaced the necessity for commercial transatlantic short-wave radio communications, but amateur radio enthusiasts may be highly interested in this subject. Another practical use of this data may be for astronauts who will soon be working on the space station, since they will have a very personal stake in reliable predictions concerning heavy particle showers while they are relatively unprotected during space walks. I hope that many readers will discover other useful correlations.

It might be enlightening to do research on astronomical data concerning planetary positions over the past several hundred years, and select out those times when the planets occupied both favorable and unfavorable positions as John describes. We just might discover other interesting correlations, perhaps with historic occurrences that may coincide, on a consistent basis, with those "good" and "bad" planetary configurations.

—Don C. Maier

SHORTWAVE RADIO PROPAGATION CORRELATION WITH PLANETARY POSITIONS

John H. Nelson

Engineering Department, RCA Communications, Inc.

Reprinted from *RCA Review*, March 1951, Vol. XII, No. 1

Summary

An examination of shortwave radio propagation conditions over the North Atlantic for a five-year period, and the relative position of the planets in the solar system, discloses some very interesting correlations. As a result of such correlations, certain planetary relationships are deduced to have specific effect on radio propagation through their influence upon the Sun. Further investigation is required to fully explore the effect of planet positions on radio propagation in order that the highly important field of radio weather forecasting may be properly developed.

Introduction

Many investigators of solar activity in the past have conducted extensive studies of planetary phenomena in an effort to account for the maximum and minimum of the eleven-year sunspot cycle and also the shorter period variations in sunspot numbers which take place from month to month. The results of several of these investigators appear to indicate a connection between the interrelationship of the planets and the degree of spottedness of the solar surface. The works of Huntington,¹ Clayton,² and Sanford,³ were found to be particularly applicable to the subject matter of this paper.

The results of their investigations suggested that a similar study relating planetary phenomena to radio disturbances over the North Atlantic might reveal information of value. Since June 1948, the author has conducted research on this subject, and this paper presents the correlation that has been found between shortwave radio disturbances and certain planetary phenomena as described below.

Motion of the Planets

The heliocentric interrelationship between Mercury, Venus, Earth, Mars, Jupiter, and Saturn was extracted from the *American Ephemeris and Nautical Almanac* published by the U.S. Naval Observatory in Washington, D.C. for the years 1942, 1944, 1947, 1948, and 1949. Dates when the heliocentric relationship of any two planets was 0°, 90°, 180°, or 270° were recorded. At 0° an inner planet is in line on the same side of the Sun with an outer planet; at 90° an inner planet is 90° ahead of an outer planet; at 180° an inner planet and an outer planet are in line on opposite sides of the Sun; at 270° an inner planet is 90° behind an outer planet. These relations are hereinafter referred to as configurations.

In addition to plotting the positions of the various planets in this way, a record was made of the solar quadrants over which each configuration took place. The solar quadrants in this study are determined by the Earth-Sun relationship under which the Sun is divided into its four quadrants as follows: The first quadrant is the visible sector of the eastern hemisphere of the Sun as viewed from the Earth; the second quadrant is the invisible sector of the eastern hemisphere; the third quadrant is the invisible sector of the western hemisphere; and the fourth quadrant the visible sector of the western hemisphere.

Every configuration of the type previously mentioned was calculated between Mercury and Venus, Mercury and Earth, Mercury and Mars, Mercury and Jupiter, and Mercury and Saturn. Following this, the same method was used with Venus and its outer planets, Earth and its outer planets, Mars and its outer planets, and Jupiter and Saturn. The analysis shows that these configurations are quite random in time and vary from cases where only one configuration between two planets takes place in a fourteen-day period to cases in which five of these six planets are involved in a configuration with some other planet within a forty-eight hour period. Cases where an inner planet makes a configuration with two outer planets within a twenty-four hour period are quite numerous.

At perihelion, Mercury moves $6^{\circ} 19'$ per day and therefore will make more configurations per unit time at this point in its orbit than at aphelion, where its speed is reduced to $2^{\circ} 44'$ per day. The variation in orbit speed of the other planets is negligible for this particular study.

Method of Observation

Each technician at the RCA Communications, Inc. Receiving Station at Riverhead, Long Island, New York, maintains a log record during his tour of duty which provides a record of conditions on shortwave signals over the North Atlantic during the midnight to 8:00 a.m. period, the 8:00 a.m. to 4:00 p.m. period and the 4:00 p.m. to midnight period. All of these eight-hour periods for the years 1942, 1944, 1947, 1948, and 1949 were correlated with existing planetary configurations and the results systematically recorded. The correlation between shortwave disturbances and planetary configurations is shown in Figure 1 for each of the years studied.

It can be readily seen from these graphs that disturbed conditions show good correlation with planetary configurations. This strongly indicates a relationship between North Atlantic shortwave signal behavior and planetary configurations. All configurations, however, are not accompanied by disturbed conditions. Analysis shows that some 0° , 90° , 180° , or 270° configurations between two planets can be nullified if one of them is close to 120° from another planet on the same day. It is, however, definitely shown that each of the six planets studied is effective in some configurations.

There seems to be a "quadrant effect" in that planets over

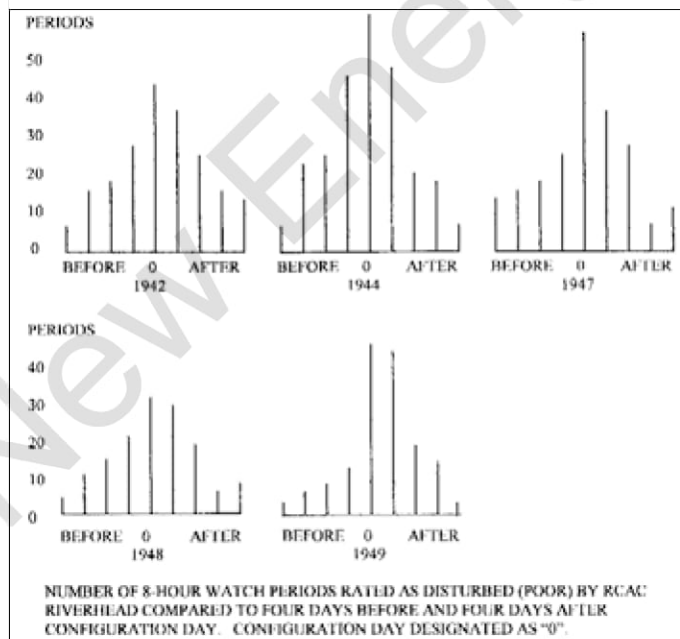


Figure 1. Correlation between disturbed periods and day of configuration.

some solar quadrants show better correlation with disturbed conditions than when over other quadrants. The two most effective quadrants are shown in the study to be the first and third quadrants and the least effective the fourth quadrant. Good correlation exists with configurations of the 180° type wherein the inner planet is over the first quadrant and the outer planet over the third quadrant.

The results of a special study of Mercury when this planet was over the first quadrant and the outer planet was over the third quadrant are shown below. (The period of plus and minus one day from configuration day or a three-day period was considered in determining whether correlation was made with radio conditions.)

Planets	Number of Configurations of Above Type	Number of Configurations Disturbed
Mercury — Venus	4	4
Mercury — Mars	6	5
Mercury — Jupiter	5	3
Mercury — Saturn	4	3

The best correlation is found between shortwave disturbances and configurations of the multiple type. Analysis shows that the closer a configuration comes to being a multiple, the greater the likelihood of a disturbance. In a multiple configuration one fast inner planet will make a configuration with two slower outer planets while the two outer planets are themselves actually in configuration or close to a configuration. An example would be Mercury reaching a position where it was 90° behind Venus and 180° from Jupiter, which places Venus 90° behind Jupiter. Configurations of this type, surprisingly, are quite common. Six examples are shown below.

- 1) February 7, 1944 Mercury — Venus 0°
February 8, 1944 Mercury — Jupiter 90°
February 8, 1944 Venus — Jupiter 90°
(February 7 to 10 were severely disturbed)
- 2) April 12, 1949 Mercury — Venus 0°
April 12, 1949 Venus — Jupiter 90°
April 12, 1949 Mercury — Jupiter 90°
(April 11 to 13 were severely disturbed)
- 3) January 23, 1947 Mercury — Earth 180°
January 24, 1947 Mercury — Saturn 180°
January 26, 1947 Earth — Saturn 0°
(January 25 was severely disturbed)
- 4) May 14, 1947 Earth — Jupiter 0°
May 15, 1947 Mercury — Jupiter 180°
May 15, 1947 Mercury — Earth 180°
(May 13 to 17 were severely disturbed)
- 5) February 22, 1948 Venus — Jupiter 180°
February 23, 1948 Mercury — Venus 90°
February 23, 1948 Mercury — Jupiter 270°
(February 23 to 25 were severely disturbed)
- 6) April 18, 1948 Mercury — Venus 180°
April 19, 1948 Mercury — Jupiter 90°
April 21, 1948 Venus — Jupiter 270°
(April 19 to 23 were severely disturbed)

The relationship between the positions of Jupiter and Saturn is very important in respect to multiple configurations. During those years when these two planets are separated by 0° , 90° , 180° , and 270° , there will be a greater number of multiple configurations since these planets move very slowly. Hence, the faster inner planets will make a double configuration in rapid time sequence every time one of them makes a contact with either Jupiter or Saturn. This is particularly so in the case of Mercury or Venus.

Correlation of Observations

The encouraging correlation found between ionospheric disturbances over the North Atlantic and configurations (particularly of the multiple type) for 1942, 1944, 1947, 1948, and 1949 suggest the following deductions:

- 1) That the most disturbed twelve-month periods will be those preceding and following configurations of the 0° , 90° , 180° , and 270° type between Saturn and Jupiter.
- 2) That the most disturbed parts of the periods in 1) will be those in which Mars is close to a configuration of the 0° , 90° , 180° , and 270° type with either Saturn or Jupiter.
- 3) That the most disturbed part of the periods in 2) will be weeks when Earth, Venus, or Mercury has a configuration of the 0° , 90° , 180° , or 270° type with either Saturn, Jupiter, or Mars.
- 4) That the most severe disturbances of all will come when the combined influence of Mars, Earth, Venus, and Mercury are such that all four will be arranged in positions where there will be a great concentration of planetary influence near the 0° , 90° , 180° , or 270° points of the Saturn-Jupiter team during the configurations mentioned in 1).
- 5) That the least disturbed periods will be those preceding and following periods when Saturn and Jupiter are separated by 120° , the principal disturbances during these periods coming from configurations of the 0° , 90° , 180° , or 270° type that the inner planets Mars, Earth, Venus, and Mercury make among themselves, or as a multiple with either Saturn or Jupiter.
- 6) That the least disturbed periods of all will be those when Saturn, Jupiter, and Mars are equally spaced by 120° , the principal disturbances during these periods coming from configurations that Earth, Venus, and Mercury make among themselves, or as multiples with Saturn, Jupiter, or Mars. Configurations of the multiple type are less frequent during an arrangement of 120° among these three slow outer planets.
- 7) That 60° relationships between planets will also tend to produce "least disturbed periods" since 60° is one half of 120° .

An exact arrangement of 120° as mentioned in 6) is rare but a very close approach to it occurred in 1934 when Jupiter was 120° behind Saturn on June 1. During August, Mars came to the 120° position with both Jupiter and Saturn within a few days, while Jupiter and Saturn were 117° apart. Magnetic activity records show that the 1934 yearly average was the lowest recorded between 1930 and 1949.

Considerable scientific study has been devoted to the great magnetic storm and aurora of July 26 to 30, 1946. Figure 5 shows the positions of the six planets as they were at zero Greenwich mean time July 27, 1946. The space separation between the planets is given below:

Jupiter—Saturn	$91^\circ 45'$
Jupiter—Earth	$92^\circ 55'$
Saturn—Earth	$175^\circ 20'$
Mars—Mercury	$89^\circ 12'$

The speed of Mercury carried it past the 90° point in relation to Mars a few hours after zero and into a multiple configuration with Saturn and Jupiter on July 30.

The heliocentric positions of the planets are shown in Figures 2, 3, and 4 for three other severe storms, March 23 to 26, 1940; September 18 to 20, 1941, with aurora; and January 3 and 4, 1946, with aurora.

Since 1946 a short-term (twenty-four hours) forecasting system has been under development at the Central Radio Office of RCA Communications, Inc. in New York City. An observatory, housing a six-inch refracting telescope, is maintained and daily solar observations, weather permitting, are made and correlated with existing radio conditions. From these solar observations,

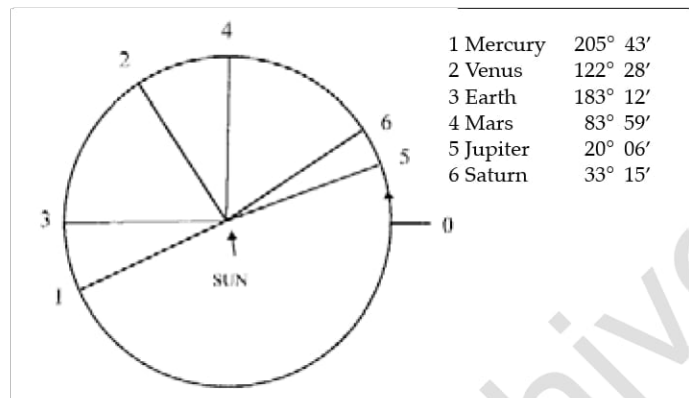


Figure 2. Heliocentric longitude of planets during disturbances on March 24, 1940.

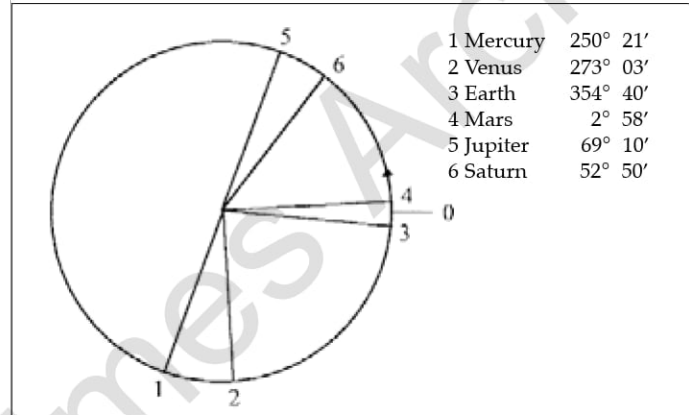


Figure 3. Heliocentric longitude of planets during disturbances on September 18, 1941.

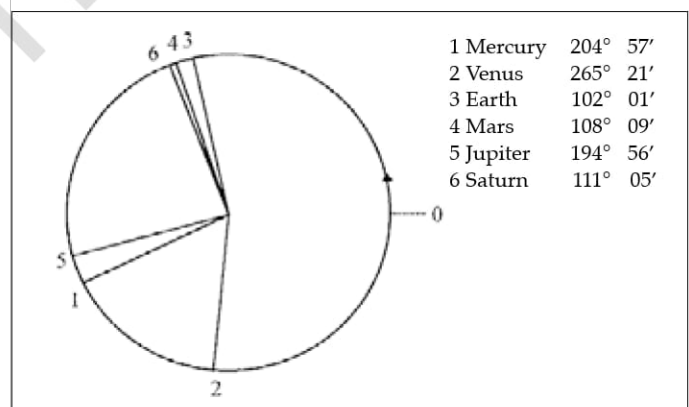


Figure 4. Heliocentric longitude of planets during disturbances on January 3, 1946.

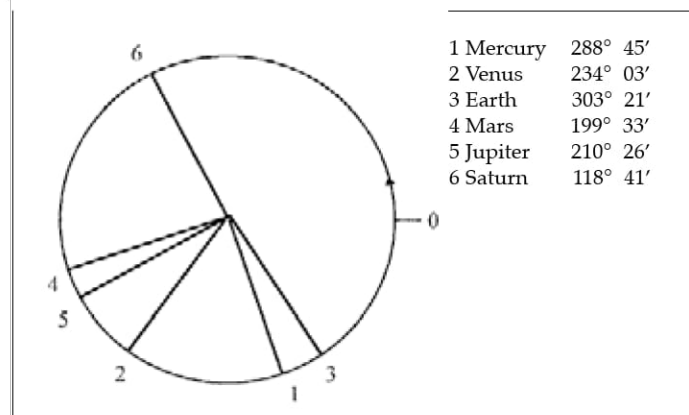


Figure 5. Heliocentric longitude of planets during disturbances on July 27, 1946.

consisting of a study of the solar surface by eyepiece, and the mapping and classifying of all sunspots, a forecast for the following twenty-four hours is made. These forecasts when compared to actual radio conditions have been attaining an accuracy of around 80%, as reported by RCA Communications, Inc., Riverhead, New York and Radio Suisse, Berne, Switzerland.

Conclusion

The research conducted at this Observatory since 1946 has quite definitely indicated that sunspots themselves are not the full answer to the problems that are manifest. There is very strong evidence that some other forces are at work in addition to the sunspots. *The need of a new approach is indicated.* The study of the planets as a new approach to propagation analysis has netted the encouraging results that are given in this paper and shows sufficient promise to warrant further and deeper study. A highly developed forecasting technique of this type would enable forecasting to be done several years ahead since advance planetary phenomena can be calculated with very great accuracy.

Acknowledgments

Grateful acknowledgment is made to H.C. Ingles, President of RCA Communications, Inc., for his approval, interest, and encouragement given the author throughout the project. Appreciation is expressed for the valuable daily radio propagation reports received from: the Riverhead staff, in particular, A.T. Ellwood; Compagnie Radio-France, Paris, France; and Direction Generale des Telegraphs de Suede, Stockholm, Sweden. Valuable assistance is acknowledged to Carl W. Nelson, Gloucester, Massachusetts, in the determination of the "least disturbing angles."

References

1. Huntington, E. 1923. *Earth and Sun*, Yale University Press, New Haven, Connecticut.
2. Clayton, H.H. 1943. *Solar Relations*, Clayton Weather Service, Canton, Massachusetts.
3. Sanford, F. 1936. *Influence of Planetary Configurations Upon the Frequency of Visible Sunspots*, Smithsonian Institution, Washington, D.C.

Supplement, Dated June 14, 1951

Since the publication of "Shortwave Radio Correlation with Planetary Positions" in the March 1951 issue of *RCA Review*, it has been decided that it would be desirable to show by percentage comparisons the observed effectiveness of multiple configurations upon signal qualities. It was stated in the paper that multiple configurations are the most important.

In the specific study of Multiple Configurations, we find that results are shown in Table 1. A multiple configuration was considered to exist when two slow planets were within 5° from being in configuration themselves at the time a fast planet made a configuration with them. An example would be Jupiter at 0°, Venus at 177°, and Mercury passing through the 90° position of Jupiter and the 270° position of Venus, followed two days later by Venus passing through the 180° position of Jupiter. A multiple period is considered to be from the day before the first configuration to the day after the last configuration.

Table 1. The correlation for 1948, 1949, and 1950 is shown.

Year	A	B	C	D	E	F	G	H	I
1948	130	1098	11.8%	282	33.4	65	31.6	23%	11.8-23%
1949	138	1095	12.6%	346	43.5	66	22.5	19%	12.6-19%
1960	307	1095	28.6%	210	58.9	84	25.1	40%	28.0-40%

- Total number of disturbed watches in year.
- Total number of watches in year.
- Percentage of watches disturbed during the year ($A/B \times 100$).
- Total number of watches in year that occurred during multiple configuration periods.

- Number of multiple configuration watches that we should EXPECT to be disturbed IF multiples had no effect on signals. This is ($C \times D$).
- Observed number of multiple watches disturbed according to records.
- Excess of disturbed multiple watches ($F - E$).
- Percentage of multiple watches that were actually disturbed.
- Comparison of C versus H.

The author attributes the increase in number of disturbed watches during the last half of 1950 over 1948/49 as due to Jupiter and Saturn approaching their 180° relationship which takes place on August 3, 1951. Also, it is considered important that the multiple configurations were executed in shorter periods of time in 1950 than in 1948/49. The number of watches per multiple periods averaged 20 per multiple in 1948, 23 per multiple in 1949, and 17.5 per multiple in 1950.

J.H. Nelson
June 14, 1951

About Don C. Maier

Don C. Maier started out to become an electrical engineer, but his education was interrupted by World War II and an all-consuming interest in playing Big Band music. Don entered the Army Air Corps in 1943 and helped win the D-Day invasion, flying B-17s all over Europe. He stayed with the U.S. Air Force for ten years as a pilot and Communications Officer. His education continued with numerous technical courses as part of his job and college courses wherever they could fit in. Upon leaving the Air Force, Don became a Philco Technical Representative and was promptly assigned right back into the same Air Force organization he had just left but now as a civilian maintenance advisor. After ten years with Philco, Don went back into government service as a technical consultant with the U.S. Army Communications-Electronics Command.

Don retired in 1986, went back to school again, and now lives with his wife Elaine in Enterprise, Alabama. He continues writing, singing Barbershop harmony, and wonders how he ever had time to work!
*220 Omega Circle, Enterprise, Alabama 36630-1423;
Phone: (334) 347-3895.



Plasma-Discharge Electrolysis Exploration System

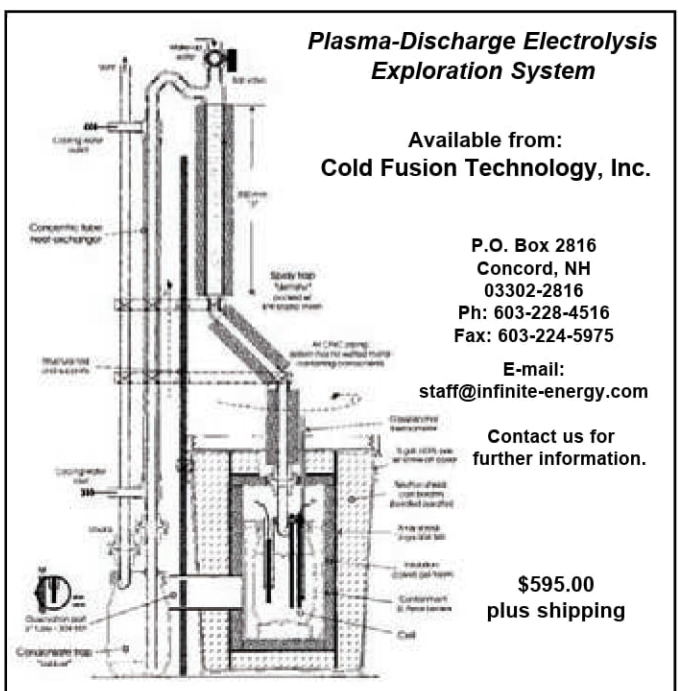
Available from:
Cold Fusion Technology, Inc.

P.O. Box 2816
Concord, NH
03302-2816
Ph: 603-228-4516
Fax: 603-224-5975

E-mail:
staff@infinite-energy.com

Contact us for
further information.

\$595.00
plus shipping



The Gravitational Red Shift and Time Dilation

H.C. Josephs*

Abstract

The increase in the wavelength of a photon as it propagates out of a gravitational potential well, known as the gravitational red shift, was first demonstrated experimentally by Pound and Rebka in 1960.¹ Since then numerous authors have verified the red shift, both experimentally and theoretically, as a natural outcome of Einstein's General Theory of Relativity. The gravitational time dilation, the expansion of time as measured by a clock deeper in a gravitational potential well with respect to an observer, was proposed by Einstein to be in addition to or equivalent to the gravitational red shift. In this paper it is shown that the two effects cannot coexist. The fact that Newton's and Einstein's theories of gravity both require the existence of the red shift supports the conclusion that gravitational time dilation is non-existent and that the red shift alone accounts for the experimental evidence. An experiment is proposed which could resolve the question.

The Gravitational Red Shift

Because Einstein's gravitational theory must agree with Newton's in the weak-field limit, we will begin by examining the gravitational red shift predicted by Newton's theory of gravitation. To take a slightly different approach than usual, consider the situation where a photon of initial energy W , wavelength λ_0 , and effective mass of W/c^2 is emitted radially from the surface of a body with mass M and radius R , as in Figure 1. Assuming that w/c^2 is the gravitational mass of the photon,² where w is the radius-dependent energy $w = w(r)$, then the rate of change of energy of the photon with respect to the radial distance r can be expressed as

$$dw/dr = -GMw/r^2c^2 = -R_s w/2r^2 \quad (1)$$

where G is the Newtonian gravitational constant and R_s , the Schwarzschild radius of the emitting object, is defined as $R_s = 2GM/c^2$. Note that since the energy lost or gained depends only on the radial component of the motion, we can eliminate the requirement that the photon be emitted radially. Rearranging factors of Equation (1) yields

$$dw/w = -R_s dr/2r^2. \quad (2)$$

Integrating and setting $w = W$ when $r = R$ produces the result

$$\ln(w/W) = R_s(1/r - 1/R)/2. \quad (3)$$

In the limit where $r \gg R$ this reduces to

$$\ln(w/W) = -R_s/2R. \quad (4)$$

Since $w = hc/\lambda$, where h is Planck's constant and λ is the wavelength of the photon, Equation (4) becomes

$$\ln(\lambda_0/\lambda) = -R_s/2R. \quad (5)$$

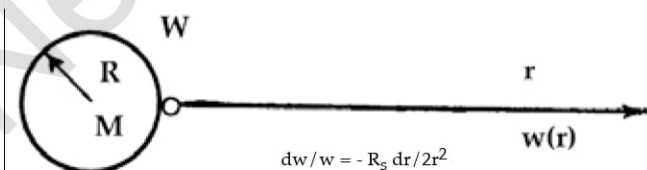


Figure 1. A photon of initial energy W is emitted from the surface of an object of mass M and radius R . The energy of the photon decreases with distance r from the object at the rate expressed by the differential equation.

Exponentiation and expansion of the right side yields the approximation that

$$\lambda/\lambda_0 = \exp(R_s/2R) = 1 + R_s/2R + \dots \quad (6)$$

from which the red shift

$$\lambda/\lambda_0 - 1 = R_s/2R = GM/Rc^2. \quad (7)$$

Equation (7) is identical to that derived from Einstein's theory.³ The exponential form in Equation (6) yields what should be a slightly more accurate result, as it is derived from a radial gravitational field rather than from a uniform field, but even in the gravitational field at the surface of the sun this makes little difference. Both yield a red shift of about 2 ppm. The red shift given for the mass and radius of the earth is 6.95×10^{-10} .

To calculate the red shift for a photon emitted from a star in a massive galaxy, one should include the effect of the gravitational field of the galaxy. However for a Sun-like star located, say, 100 light years from the center of a galaxy with a core having a mass of a hundred million suns, the red shift due to the galactic gravitational potential at the distance of the star is only about 1.5×10^{-11} as compared with 2×10^{-6} for the red shift of our Sun.

To calculate the blue shift for a photon approaching a massive body, one need only change the sign of the exponential in Equation (6). It quickly becomes apparent that for any reasonable assumptions regarding the central mass of our galaxy, the galactic blue shift at the distance of our sun from its center is negligible, as is the blue shift produced by the earth. Thus, to determine the net amount of red shift for a photon leaving a distant galaxy and approaching the earth, one need only consider the ratio of the Schwarzschild radius of the emitting body to its actual radius for normal stars in normal galaxies.

The red shift produced when a photon rises in the gravitational field of the earth can be found from Equation (3) using the values for the mass and radius of the earth given in Reference 3 and letting $r = R + h$, where h is the height to which the photon rises and $R \gg h$. Observing that $GM/R^2 = g = 9.8 \text{ N/Kg}$, which is the gravitational acceleration at the surface of the Earth, we have

$$\ln(w/W) = -Gmh/R^2c^2 = -gh/c^2 \quad (8)$$

and

$$\lambda/\lambda_0 = \exp(gh/c^2) = 1 + gh/c^2 + \dots \quad (9)$$

Thus the red shift is

$$\lambda/\lambda_0 - 1 = gh/c^2. \quad (10)$$

Newton's and Einstein's theories predict identical results.

Gravitational Time Dilation

Although it is generally acknowledged that Newton's gravitational theory predicts the gravitational red shift as well as Einstein's³⁻⁷ does, it is something that needed to be clearly stated.

The equivalence of the Newtonian gravitational red shift and gravitational time dilation is also not clearly discussed in the literature. Weinberg³ discusses the red shift in a section entitled "Time Dilation," but states only that we cannot observe the time dilation directly because gravitation affects our time standards in the same way as it affects the clocks being studied. Ohanian and Ruffini⁴ argue for the existence of time dilation in preference to the red shift. Misner *et al.*⁵ argue the reverse. Ciufolini and Wheeler⁶ state that "clocks near a mass appear to go slow-

er" but discuss the red shift and time dilation as though they are equivalent. Wald⁷ derives an expression for the red shift, but merely acknowledges the existence of a "similar" gravitational time dilation. All of these authors derive expressions equivalent to Equation (7) or Equation (10).

The importance of Equation (10) lies in its application to the experiment of Pound and Rebka¹ and to the gravitational time dilation. This experiment and the problems encountered and the solutions generated are well summarized in Reference 3. Briefly, what they achieved was a measurement of the red shift of about $2.5 \cdot 10^{-15}$ produced by a photon rising 22.6 meters in the gravitational field of the Earth, as predicted by Equation (10). Photons emitted by a sample of Fe⁵⁶ were absorbed by a second sample of the same material. The wavelength of the photons was increased by the expected amount. According to Einstein's theory, this is equivalent to the vibrational frequency of the emitter having decreased by exactly the same fraction. Einstein interpreted the gravitational red shift as being due to a slowing down of all clocks when they are moved to a lower point in a gravitational potential field, that is, to time dilation. If both effects were present simultaneously—that is, if the lower clock slowed down and then the photons it emitted were red shifted—the total effect would be twice as great as observed. It has been experimentally determined with fairly high accuracy⁸ that this does not happen. The two effects do not coexist, as the observed red shift is not twice the calculated value. The question now arises, "Which one really does exist in nature?"

In resolving this question, one should first observe that there is no known underlying physical phenomenon which would cause an increase in gravitational potential to result in clocks of any and all designs slowing down as the first power of the gravitational potential. Pendulums, cavity resonators, quartz crystals, and atoms all rely on totally different physics. There is, however, a well-known process by which photons can lose energy in a gravitational field: that which was used in the derivation of the ten equations above.

Second, note that if time dilation truly exists, then it is a relativistic effect which acts on all clocks without regard to design, and there is no other underlying physics. If that were the case, photons would have to be insensitive to gravity; $m_g = E/c^2$ could not apply to photons and the Newtonian red shift would not exist. However, if experiment should establish the existence of both effects, then, because the total red shift has been shown to be as predicted by the equations, there would be a dilemma similar to the dual nature of the electron wherein the result of an experiment depends on what the experiment is designed to test.

Third, observe that most of the experiments testing these effects and all of the more accurate ones⁸ have measured only the total gravitational red shift, not time dilation or Newtonian red shift separately. Since Newton's law predicts the red shift correctly, but does not predict time dilation, this is an important point.

Fourth, observe that photons are not the same as electromagnetic impulses. A photon has a certain frequency and wavelength, but not a specifiable number of cycles or a specific physical location. From the photoelectric effect it is apparent that photons behave like point particles. Now consider, for example, a radar magnetron producing a pulse with peak power P of one kilowatt, pulse width T of 100 ns, pulse repetition rate PRR of 10^5 pulses per second, and wave length λ of 1 cm, as shown in Figure 2. Each photon also has a wave length of 1 cm with an energy of $hc/\lambda = 2 \cdot 10^{-23}$ J, where h is Planck's constant. The wave length of both the carrier frequency and the photons are determined by the physical dimensions of the magnetron. Each pulse has an energy W of 10^{-4} J and a spatial length of 30 m, containing 3000 cycles of the carrier. Each pulse contains $5 \cdot 10^{18}$ photons, each located somewhere within the cross sectional area and spatial length of the radar pulse. The carrier frequency of a radar pulse, which determines the wave length and energy of

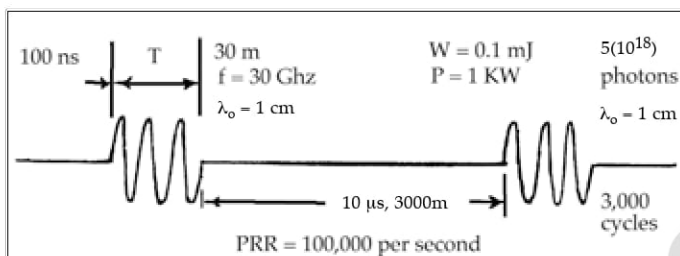


Figure 2. A radar pulse of 3000 cycles of a 30 GHz carrier wave with an energy of 0.1 mJ per pulse contains $5 \cdot 10^{18}$ photons, each located someplace within the cross sectional area of the radar beam and the physical length of the pulse of 30 meters.

the emitted photon, can be changed without affecting the pulse width or repetition rate. Similarly, the rate at which light (or any other electromagnetic radiation) is turned on and off or the on-to-off time ratio can be changed without affecting the wavelength of a photon of the light (or other radiation).

Since there are three clock intervals used in a radar set ($1/f$, T , and $1/PRR$), time dilation would require that all three expand in a gravitational field, decreasing the frequency and PRR and increasing the pulse width, all by the same fraction. This must be true even though f is controlled by a resonant cavity, T is controlled by the length of a delay line, and the PRR is controlled by a relaxation oscillator. The crucial point, however, is that for Newtonian red shift only the frequency f would be affected, as the period of the carrier is the only one of the three clock intervals that is determined by the photons. One might argue that Fourier Analysis would require the presence of photons at frequencies of $1/T$ and PRR, and all harmonics thereof. The magnetron, however, generates no photons at any frequencies other than f and time-domain analysis supports this observation. Thus, under Newton's law the pulse width and number of pulses per second do not change in a gravitational field. This distinction should provide a definitive test of the validity of each theory.

Conclusions

To resolve the question, one needs to design a single experiment which measures both time and frequency. One would need an apparatus in which the oscillator output of, say, an atomic clock of frequency f is gated on and off by another atomic clock of a much lower rate P . An identical apparatus is placed at a high altitude, perhaps on the Moon. Each apparatus records the number of pulses it has generated N and periodically transmits it as a digital number to the other, as shown in Figure 3.

It is known from Equation (7) that the red shift will be: $GM/Rc^2 = 6.95 \cdot 10^{-10} = (f_2 - f_4)/f_2$, which is equal to the blue shift $(f_3 - f_1)/f_1$. This is well within the accuracy of present-day atomic clocks.⁹ We also know that $f_4 < f_2$, which shows that the energy per photon has been reduced. This means that the energy per pulse has been reduced by the same amount, because the number of photons in the pulse cannot change.

There are just two possibilities regarding the number of pulses recorded:

1) $(N_2 - N_4)/N_2 = (N_3 - N_1)/N_1 = GM/Rc^2$. This result would indicate that the pulse rates are affected by gravity in the same manner as the photon frequencies. In order to detect differences in pulse numbers, the clocks would have to operate reliably for about a day to generate about 10^{10} pulses for the conditions illustrated in Figure 3. The expected result would then be $N_3 - N_1 = 7$. This result would imply that time dilation alone exists, photons have no gravitational mass, there is no Newtonian gravitational red shift, and Einstein's equation, $m_g = E/c^2$, does not apply to photons. This interpretation would support the hypothesis that clocks slow down in a gravitational field, but would prove the hypothesis only as it applies to atomic clocks. The hypotheses as applied to other types of clocks would still not have been tested.

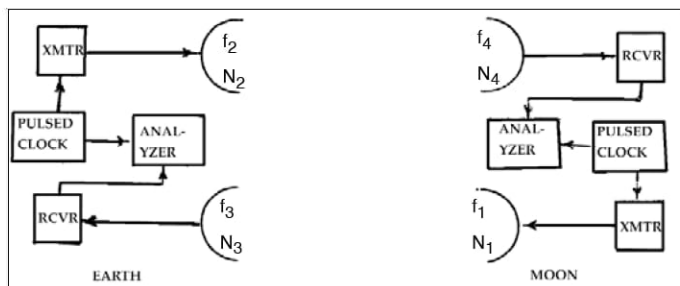


Figure 3. The values of the red shift of the carrier frequencies $(f_2 - f_4)/f_2$ and the blue shift $(f_3 - f_1)/f_1$ are expected to equal the value predicted by both Newton and Einstein, GM/Rc^2 . If the numbers of pulses sent and received show the same shift as the frequencies, then the time dilation exists but not a gravitational red shift. If the numbers of all the pulses sent and received are equal to each other, then the red shift exists but not time dilation. Gravitational red shift and time dilation cannot coexist.

Alternatively, this could be interpreted to mean that time dilation and red shift exist simultaneously but independently, in such a way that any experiment is capable of measuring only one of the two effects. Thus, the total wavelength change would not be doubled. This interpretation would require formulation of a new theory regarding these effects.

2) $N_1 = N_2 = N_3 = N_4$. The numbers of pulses sent and received agree in all cases. This is the only result which would support Newton's theory. It implies that gravitational time dilation has no real existence and that the Newtonian red shift alone accounts for the experimental observations. Clocks, or certain kinds of clocks, only "appear to go slower" when viewed from above.

References

1. Pound, R.V. and Rebka, G.A. 1960. *Phys. Rev. Lett.*, 4, 339.
2. This is not in conflict with the precepts of Josephs, H.C. "Inertial and Gravitational Mass of Moving Bodies," Submitted for publication, *Infinite Energy Magazine*, 1999. That was concerned with massive bodies moving at subluminal speeds. This is concerned with photons.
3. Weinberg, S. 1972. *Gravitation and Cosmology*, John Wiley & Sons, New York.
4. Ohanian, H.C. and Ruffini, R. 1994. *Gravitation and Spacetime*,

W.W. Norton & Co., New York.

5. Misner, C.W., Thorne, K.S., and Wheeler, J.A. 1973. *Gravitation*, W.H. Freeman & Co., New York.

6. Cuifolini, I. and Wheeler, J.A. 1995. *Gravitation and Inertia*, Princeton University Press, Princeton, NJ.

7. Wald, F.M. 1984. *General Relativity*, University of Chicago Press, Chicago.

8. Vessot, R.F.C. et al. 1980. "Test of Relativistic Gravitation with a Space-Borne Hydrogen Maser," *Phys. Rev. Lett.*, 45, 26, 2081-2084.

9. Weiss, P. 1999. "Fountains of Time," *Science News*, 156, 6.

About the Author

Harold (Hal) Josephs became interested in atomic and nuclear physics

with the announcement of the destruction of Hiroshima. He developed his interest in relativity during his four-year term of service in the Air Force. He was educated at Midwestern University, Wichita Falls, Texas; the University of Minnesota; and in 1959 received the Master of Electrical Engineering degree from New York University (NYU). While at Minnesota, he worked three years as an engineer on the linear proton accelerator in the Physics department. He was employed by Bell Telephone Laboratories, Murray Hill, New Jersey in the Solid State Device Development Department for three years, while attending NYU. He worked for ten years for Honeywell, Inc. in Minneapolis in a variety of positions, mostly at the Solid State Electronics Center, developing integrated circuits and IC production processes. He spent the last twenty-one years of his working career as a Professor of Electronics at the Alexandria Technical College, Alexandria, Minnesota.

Mr. Josephs has published more than two dozen technical papers and has several U.S. patents. He has served on technical and political committees and organized the first Solid State Sensors Symposium. He was a senior member of the Institute of Electrical and Electronic Engineers (IEEE) and served as guest editor of the IEEE "Transactions on Electron Devices." Mr. Josephs is a licensed private pilot and extra class amateur radio operator. He retired from academia in 1990 and has engaged in cold fusion research since 1989. In 1996 he moved with his wife, Ruby Donahue, to New Mexico where they still reside. Their children are scattered from coast to coast.

*HCR 64, Box 708, Guadalupita, New Mexico 87722



Who Was That Balloonist?

A man is flying in a hot air balloon and realizes he is lost. He reduces height and spots a man down below. He lowers the balloon further and shouts:

"Excuse me, can you tell me where I am?"

The man below says, "Yes you're in a hot air balloon, hovering thirty feet above this field."

"You must work in a technical or scientific position," says the balloonist.

"I do," replies the man. "How did you know?"

"Well," says the balloonist, "everything you have told me is technically correct, but it's of no use to anyone."

The man below says, "And you must be in upper management of some business."

"I am," replies the balloonist, "but how did you know?"

"Well," says the man, "you don't know where you are and aren't sure where you're going, but you expect me to be able to help. You're in about the same position you were before we met, but now it's my fault."

—Internet Humor



THE HOMOPOLAR HANDBOOK:

A Definitive Guide to Faraday Disk and N-Machine Technologies

by Thomas Valone
\$23.95 No. America
\$28.95 Foreign
Paperback, 188 Pages

ORDER FROM:
Cold Fusion Technology, Inc.
P.O. Box 2816, Concord, NH 03302-2816
Phone: 603-228-4516
Fax: 603-224-5975



COLD FUSION TIMES

The Journal of the Scientific Aspects of Loading Isotopic Fuels Into Materials

Published Quarterly

Publisher and Editor, Dr. Mitchell Swartz

Annual Subscription Rate \$120/Single Issues \$40
Outside U.S. add extra \$5.

P.O. Box 81135, Wellesley Hills, MA 02181 USA

Erroneous Predictions in the History of Science

Excerpts from *Erroneous Predictions and Negative Comments Concerning Exploration, Territorial Expansion, Scientific and Technological Development* Prepared at the request of the Senate Committee on Aeronautical and Space Sciences by Nancy T. Gamarra, April 10, 1967

Comment in *The New York Times* one week before the successful flight of the Kitty Hawk by the Wright Brothers:

"... We hope that Professor Langley will not put his substantial greatness as a scientist in further peril by continuing to waste his time, and the money involved, in further airship experiments. Life is short, and he is capable of services to humanity incomparably greater than can be expected to result from trying to fly. . . For students and investigators of the Langley type there are more useful employments."

The New York Times, December 10, 1903, editorial page.

Simon Newcomb wrote:

"... The demonstration that no possible combination of known substances, known forms of machinery and known forms of force, can be united in a practical machine by which man shall fly long distances through the air, seems to the writer as complete as it is possible for the demonstration of any physical fact to be."

Clarke, Arthur C. *Profiles of the Future*, Harper & Row, New York, 1962, pp. 2-3.

Utility of electric lighting for general purposes:

"... I do not think there is the slightest chance of its (electricity) competing, in a general way, with gas. There are defects about the electric light which, unless some essential change takes place, must entirely prevent its application to ordinary lighting purposes."

Remarks of Mr. Keates, *Minutes to Evidence Taken Before the Select Committee on Lighting by Electricity in Report from the Select Committee on Lighting by Electricity*, London, House of Commons, 1879, p. 146.

Panama Canal:

"The Panama Canal is actually a thing of the past, and Nature in her works will soon obliterate all traces of French energy and money expended on the Isthmus."

Scientific American, January 1941, p. 4.

Highways:

"The actual building of roads devoted to motor cars is not for the near future, in spite of many rumors to that effect."

Harpers Weekly, August 2, 1902, p. 1046.

In 1591 Colonel Sir John Smyth advised the British Privy Council:

"... The bow is a simple weapon, firearms are very complicated things which get out of order in many ways. . . a very heavy weapon and tires out soldiers on the march. Whereas also a bowman can let off six aimed shots a minute, a musketeer can discharge but one in two minutes."

Wintringham, Thomas H. *The Story of Weapons and Tactics*, Houghton Mifflin Co., Boston, 1943, p. 101.

Criticism of Darwin's theory:

"Those who accept Mr. Darwin's account of the descent of man must accept along with it not a little that is, if possible,

even more incredible. For example, while a certain monkey race has, by a series of insensible gradations, occurring during a period of enormous length, developed into man, other monkey races, during a yet longer period, have remained monkeys, making no progress whatever! Mr. Darwin, I presume, would maintain that at least half a million of years have passed since man emerged into humanity from the last of his ape-like progenitors. How far remote, then, must be the time when the ape from which man has descended, branched away from the stem of the Old World monkeys! But during this period—so long that, to us, it is practically an eternity—Old World monkeys have remained Old World monkeys, with the solitary exception of that wonderful member of the ancient series of the Primates, with his plastic frame, of which Mr. Darwin catches 'an obscure glance' through the dim vista of ages."

Lyon, William Penman. *Homo Versus Darwin, A Judicial Examination of Statements Recently Published by Mr. Darwin Regarding the Descent of Man*, London, Hamilton, Adams and Co., 1871, p. 145.

Opposition to use of anesthesia:

The famed surgeon Alfred Velpeau wrote in 1839:

"The abolishment of pain in surgery is the chimera. It is absurd to go on seeking it today. 'Knife' and 'pain' are two words in surgery that must forever be associated in the consciousness of the patient. To this compulsory combination be shall have to adjust ourselves."

Gumpert, Martin. *Trail-Blazers of Science*, New York, Funk and Wagnalls Company, 1936, p. 232.

Possibility of developing intercontinental missiles:

Dr. Vannever Bush said in December of 1945:

"There has been a great deal said about a 3,000 miles high-angle rocket. In my opinion such a thing is impossible for many years. The people who have been writing these things that annoy me, have been talking about a 3,000 mile high-angle rocket shot from one continent to another, carrying an atomic bomb and so directed as to be a precise weapon which would land exactly on a certain target, such as a city. . .

I say, technically, I don't think anyone in the world knows how to do such a thing, and I feel confident that it will not be done for a very long period of time to come. . . I think we can leave that out of our thinking. I wish the American public would leave that out of their thinking."

Clarke, Arthur C. *Profiles of the Future*, New York, Harper and Row, 1962, p. 9.

Development of the atomic bomb:

Dr. Vannever Bush told President Truman in 1945:

"That is the biggest fool thing we have ever done. . . The bomb will never go off, and I speak as an expert in explosives."

Truman, Harry S. *Memoirs, Vol. I: Year of Decisions*, Garden City, Doubleday and Company, Inc., 1955, p. 11.

Limited utility of radio:

Friends of Lee de Forest asked:

"Well, then of what possible use can your 'radiotelephone' be? It can't compare with the wire 'phone, you say, and it can't cover the distances that the wireless telegraph can cover. Then what the hell use is it anyway, Lee?"

De Forest, Lee. *Father of Radio: the Autobiography of Lee de Forest*, Chicago, Wilcox and Follett Co., 1950, p. 227.

Watch for more of these erroneous predictions in upcoming issues.

Checkerboard Structure of the Nucleus

Theodore M. Lach, II*

Excerpted from an e-mail to Eugene Mallove:

I have enjoyed reading all the back issues of *Infinite Energy*. I find the topic of cold fusion very interesting. Without *Infinite Energy Magazine* I do not know if I would have ever been kept up to date on this subject. I followed the day-to-day discussions that you and others had on the news groups back in 1989 and found those discussions interesting also.

... This paper has been rejected by *Physical Review Letters* (because it did not contain enough quantum mechanics) and *Physical Review-C* (because it was not up to their usual standards). I tried to get it published in its current form in the proceedings of the Nuclear Physics meeting at Shanty Creek in 1998 (upper Michigan). The editor said that the topic was not close enough to the other papers and topics presented.

I have shown this theory to one of the top nuclear physicists at Argonne National Laboratory and he said it was "cute." I have shown this theory to one of the top particle physicists at Fermi Lab and he said "it might have calculable value."

Most people I talk with do not want to talk to me about what is wrong with my theory. By putting it in your magazine I may get the visibility for that discussion to begin. I have presented my theory at five of the last APS meetings either as poster sessions or ten minute presentations. No one is taking this theory seriously.

—Theodore Lach

A flat structure of the nucleus better explains such properties of the nucleus as its stability and the existence of the known isotopes. This new model is called the Checkerboard Model (CBM). It has features similar to the Bohr model of the atom and the alpha model of the nucleus proposed fifty years ago.

Any successful theory of the nuclear strong force will have to explain some key properties of the nucleus. The most important of these are:¹

- 1) Electrons are not affected by the nuclear force.
- 2) The nuclear force depends upon whether the spins of the nucleons are parallel or anti-parallel.
- 3) The nuclear force includes a repulsive component that keeps the average separation of the nucleons at a distance of 1.8 fm. Given this distance and the accepted radius of the proton and neutron (about .45 to .65 fm),^{2,3} it must be concluded that only about 1/15 of a spherical nucleus contains nuclear matter.³
- 4) The nucleon-nucleon force has a non-central (tensor) component, which is the major contributor to the strength of the strong nuclear force.
- 5) The neutron distribution extends beyond the proton distribution in large nuclei.²
- 6) The nuclear strong force is known to have a very short range decreasing to 1% of its normal value when the distance between nucleons doubles,⁴ making it about the same strength as the electromagnetic force at that distance.
- 7) For distances of the normal average separation (1.8 fm) the strong nuclear force is 100 times as strong as the electromagnetic force.⁴
- 8) Size of the nucleus.
- 9) Binding energy per nucleon.
- 10) The nuclear force turns repulsive for proton radius of less than 0.5 fm.

The new model that is being proposed is called the Checkerboard Model (CBM) because it starts out by assuming that the nucleons are not oriented in a spherical ball, but instead are oriented on a two-dimensional plane patterned

like a checkerboard. The model also assumes, just like in the game of checkers, that the protons can only occupy the dark colored squares of the checkerboard and the neutrons can only occupy the light colored squares. Therefore, there is never a proton next to a proton or a neutron next to a neutron in the nucleus. Since, in this model, bonding essentially only occurs at right angles, this model explains, quite simply, why two protons or two neutrons do not form stable bonds. It also explains why the spin of the nucleus is a multiple of spins of the proton and neutron. Based upon this model, the alpha particle would have the structure shown in Figure 1.

This model evolved from the idea that perhaps the structure of the alpha particle, known to be very stable, was a result of the two like quarks in a nucleon spinning around the odd quark in the nucleon. From this model we see that the +2/3 up quarks of the protons will be approaching the -1/3 down quarks of the neutrons at the perimeter of the nucleons. Also, note that in the proposed alpha particle structure there is one spin up proton and one spin down proton. The same is true for the two neutrons. This gives rise to the rationale for the nucleon pairing stability.

The model requires that the rotational speed of the quarks in the protons and neutrons be matched. This is consistent with the spin of the two nucleons being the same. The matched spins are required since this model postulates that the quarks of opposite charge approaching each other at the nucleon perimeters are the major component of the strong nuclear force (the tensor term). Since the quarks are nearly touching at the perimeter of the nucleons, the force generated by this attraction rises with the inverse square of the distance, thereby accounting for the strength of the tensor component of the strong force. This explains why the nuclear force is so strong, since the approach distance of the quarks is about ten times closer and less random than previously thought. It was also a mystery why a zero charged particle (the neutron) would have a magnetic moment. The CBM can now explain the source of the magnetic moment of the neutron. The magnetic lines of flux also add additional strength to the alpha structure in the third dimension. The orientation of magnetic flux fields also explains why the nucleon spin orientations affect the nuclear binding energy and the strong force.

Using the relative size of the magnetic moment, the charge on the quarks, and the assumption that both the proton and neutron have the same frequency of rotation, the model gives the relative radius of the proton and neutron using the following equations. Note, the model assumes the quark in the center of each particle does not contribute to the magnetic moment.

$$\mu = I A = q(\text{rotating quarks}) f (\pi r^2)$$

$$\mu_{\text{proton}} = 2(2/3) f \pi (r_{\text{proton}})^2$$

$$\mu_{\text{proton}} = 2(-1/3) f \pi (r_{\text{neutron}})^2$$

$$\mu_{\text{proton}} / \mu_{\text{neutron}} = -2(r_{\text{proton}} / r_{\text{neutron}})^2$$

$$r_{\text{neutron}} / r_{\text{proton}} = [2[0.96623707 / 1.41060761]]^{1/2}$$

$$r_{\text{neutron}} = 1.1704523 (r_{\text{proton}})$$

On this basis the neutron is about 17.04523% larger than the proton. It is generally accepted that the neutron is slightly larger than the proton. The ratio of the rms radius of the neutron to proton is (0.8 fm / 0.7 fm), or 1.14 is in agreement with this calculation.

The binding energy difference of the ³H vs. ³He (0.76374 MeV/c²) and the normal assump-

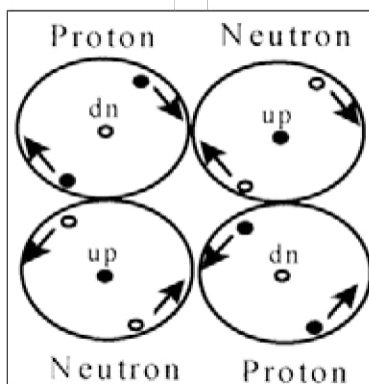


Figure 1. Structure of the helium nucleus. up = Up Quark; dn = Down Quark

tion that the difference in the binding energy between ${}^3\text{H}$ and ${}^3\text{He}$ is due to electrostatic repulsion⁵ allow us to calculate the distance (R_c) between the two protons in the ${}^3\text{He}$ structure, which is assumed to be a linear alignment (proton, neutron, proton) in this model due to the repulsion of the two protons.

$$\text{Binding Energy of } {}^3\text{H} = \text{mass } {}^3\text{H} - m_{\text{electron}} - m_{\text{proton}} - 2 m_{\text{neutron}} = 8.48183 \text{ MeV}$$

$$\text{Binding Energy of } {}^3\text{He} = \text{mass } {}^3\text{He} - 2 m_{\text{electron}} - 2 m_{\text{proton}} - m_{\text{neutron}} = 7.71809 \text{ MeV}$$

$$\text{BE}({}^3\text{H}) - \text{BE}({}^3\text{He}) = 0.76374 \text{ MeV}$$

$$\text{Coulomb repulsion in } {}^3\text{He} = \text{BE}({}^3\text{H}) - \text{BE}({}^3\text{He}) = 0.76374 \text{ MeV} = 6e^2/5R_c$$

Solving the above equation for R_c gives a value of 2.262 fm. Using the assumed linear structure for ${}^3\text{He}$ (PNP), and the radius of the neutron as being 1.1704523 times larger than the proton, results in a size of the proton of 0.5211×10^{-13} cm, and a size of the neutron of 0.6099×10^{-13} cm. These numbers are in fairly good agreement with published values.³ In fact, the scattering of the neutron by electrons shows a positive core to the neutron and a negative outer distribution that peaks at about 0.6 fm in agreement with this model.⁶ (The accepted rms radius of the neutron is 0.8 fm and the tail of its charge distribution goes out to about 1.2 fm.)

Combining the calculated size of the proton and neutron with the known magnetic moments of the proton and neutron gives the relativistic speed of the up and down quarks.

$$\mu = I A = 1/2(q v r)$$

$$v_{\text{up quark}} = 2 \mu_{\text{proton}} / \{2 (q_{\text{up quark}})(r_{\text{proton}})\}$$

$$v_{\text{up quark}} = \frac{2 (1.41060761 \times 10^{-26} \text{ J/T})}{2(2/3) (1.602095 \times 10^{-19} \text{ C})(0.5211 \text{ fm})}$$

$$\text{velocity (2 up quarks in the proton)} = 2.53447 \times 10^8 \text{ m/s} = 0.8454 \text{ the speed of light}$$

$$\text{velocity (2 down quarks in the neutron)} = 1.1704523 (v_{\text{up quark}}) = 0.9895c$$

Setting up two relativistic simultaneous equations involving the rest mass of the up and down quarks and setting that equal to the known rest mass of the proton and neutron allows the determination of the rest mass of the up and down quark.

$$m_{\text{proton}} = m_{\text{down quark}} + \frac{2 m_{\text{up quark}}}{\sqrt{1 - \left(\frac{v_{\text{up quark}}}{c}\right)^2}}$$

$$m_{\text{neutron}} = m_{\text{up quark}} + \frac{2 m_{\text{down quark}}}{\sqrt{1 - \left(\frac{v_{\text{down quark}}}{c}\right)^2}}$$

This exercise results in a calculation of the rest mass of the up and down quarks. The surprise of this exercise is that the de Broglie wavelength of the up quark in the proton almost exactly matches the circumference of the postulated size of the proton (less than 1% error).

$$\lambda_v = h / m_v v$$

$$\text{where } h = 6.626068(91) \times 10^{-34} \text{ Joule} \cdot \text{sec}$$

Iterating the size of the proton and neutron along with the speeds of the up and down quark until the de Broglie wavelength of the up quark in the proton is exactly the proton circumference results in the following values:

Radius of the proton	0.519406 fm
Radius of the neutron	0.6079394 fm
Mass of up quark	237.31 MeV/c ²
Mass of down quark	42.392 MeV/c ²
Speed of up quark in proton	0.848123 the speed of light
Speed of down quark in neutron	0.992685 the speed of light

The results of these numbers indicate that the sum of the rest mass of the two up and one down quarks in the proton account for 55% of the mass of the proton; the other 45% comes from the relativistic mass of the two up quarks. The period of revolution of the two quarks in the proton and neutron becomes 1.283533×10^{-23} seconds. These values not only give the right values for mass of the proton and neutron, and approximately correct values for the radii of the proton, they by design give the correct value of the magnetic moments for the proton and neutron. Work done by Amaldi has shown that rms radius of the proton is about 0.65 fm based upon pp scattering.⁷ Also remember that the nuclear force becomes repulsive for approach distances of less than a radius of 0.5 fm. Could this property of the strong force be justified in this model by the incompressibility of the proton, whose radius is about 0.5 fm in the CBM?

The CBM suggests why the neutron is unstable when it is outside the nucleus and stable inside the nucleus. Inside the nucleus the wavelength of the down quarks in the neutron is 6% smaller than the circumference of the neutron. The model suggests that the neutron gets extra stability from the up quarks in the proton, which have exactly a 1.0000 de Broglie wavelength. Outside the nucleus this reinforcement does not exist. Also a possible shrinking of the neutron by 10% (assuming constant angular momentum) when inside a given nucleus may resolve the 6% offset of the de Broglie wavelength of the down quarks in the neutron and may account for some of the binding energy of the structure.

Any new model of the nucleus must explain the dependence of binding energy per nucleon on the number of nucleons. The best current model that explains nuclear binding energy is the liquid drop model, which uses a bulk term, a surface term, plus a few others to explain the binding energy per nucleon in a continuous curve. The CBM is interesting, since it does not develop a smooth continuous curve, but a curve with more bumps in it, in better agreement for the low mass nuclei. The most naïve approach to this subject would have been to try to estimate the binding energy per bond, count the numbers of bonds (divided by the number of nucleons) and that would be the binding energy per nucleon. This simple approach does not work. But even with this naïve approach it becomes obvious, based upon the structures this model suggests, that ${}^{56}\text{Fe}$ will be the nucleus of maximum binding energy per nucleon, since it has the highest percentage of 4-bond sites of any nucleus, in this model. There is no other model that predicts that ${}^{56}\text{Fe}$ will have the maximum BE per nucleon. The BE per nucleon relation is more complicated than a naïve approach would indicate, because of the flux coupling of adjacent and second nearest neighbors. Therefore, the bond energy must be studied empirically based upon some few selected nuclei. The nuclei chosen for this empirical fit are: ${}^2\text{H}$, ${}^4\text{He}$, ${}^{40}\text{Ca}$, ${}^{56}\text{Fe}$, and ${}^{234}\text{U}$. ${}^2\text{H}$ is chosen because it characterizes the single bond site. ${}^4\text{He}$ is chosen because it characterizes the double bond site. Since ${}^{40}\text{Ca}$ is only comprised of 2-bond and 4-bond sites, it is used to determine the strength of a 4-bond site, since we already know the value of a 2-bond site. ${}^{56}\text{Fe}$ being a mixture of 2-, 3-, and 4-bond sites allows us to calculate the value of a 3-bond site. ${}^{234}\text{U}$ is used to calculate a value of a 1-bond site with two adjacent second-nearest-neighbor sites. These are common in the very high mass structures and are called, in this model, a 1c site. A single bond

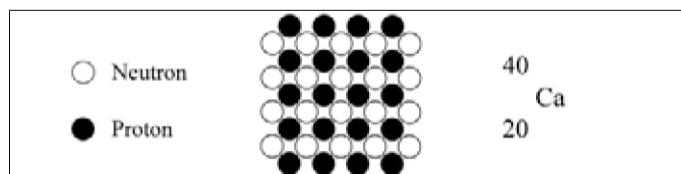


Figure 2. CBM proposed structure of ^{40}Ca .

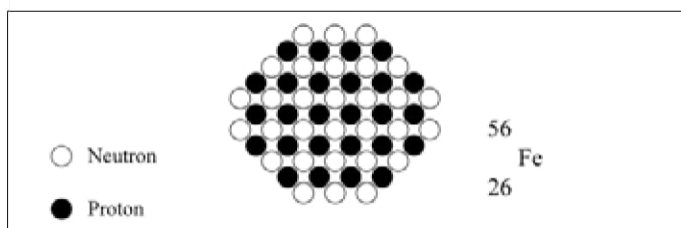


Figure 3. CBM proposed structure of ^{56}Fe .

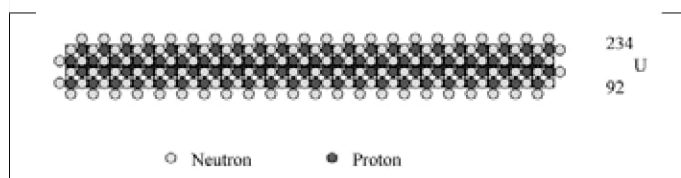


Figure 4. CBM proposed structure of ^{234}U .

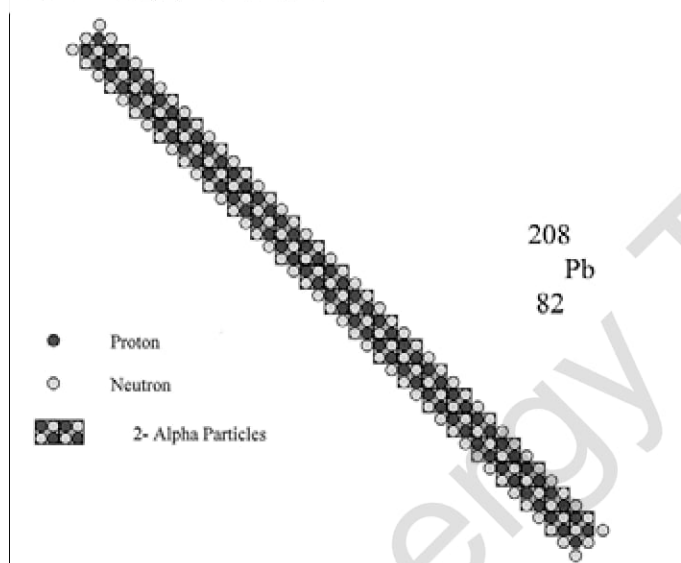


Figure 5. CBM proposed structure of ^{208}Pb .

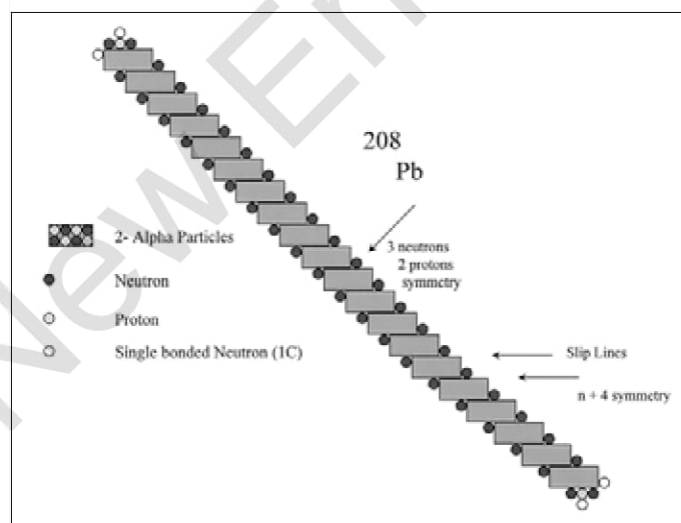


Figure 6. CBM proposed structure of ^{208}Pb .

with no second-nearest-neighbor flux coupling is a 1a site, and if the 1-bond site has one second-nearest-neighbor to add flux coupling, it is a 1b site. Here are the values needed to calculate the binding energies per nucleon.

1-bond site	1.11 MeV/c ²
2-bond site	7.07 MeV/c ²
3-bond site	8.13 MeV/c ²
4-bond site	9.53 MeV/c ²
1c-bond site	1.73 MeV/c ²
1b-bond site	1.42 MeV/c ²

Two-bond and 4-bond sites always have the same number of second-nearest-neighbors. It is possible that a 3-bond site will have one or two nearest-neighbor sites, but these structures are not common in ground state nuclei and they would add only slightly to the 8.13 MeV/c² this bond site already contains. These values give very good agreement with the accepted binding energy per nucleon values. See Figures 2, 3, and 4 for the structures of ^{40}Ca , ^{56}Fe , and ^{234}U used to make these calculations.

One interesting feature of this model is that ^{208}Pb turns out to be a structure that has a very symmetric shape (four-fold symmetry). See Figure 5. It is disturbing because it is long and thin, not what one would have expected, especially by traditional nuclear physicists. Another of its symmetries is a 3:2 symmetry. It is an alternating pattern of three neutrons followed by two protons. With the three extra neutrons, due to neutrons on both ends of the structure, this structure is perfectly symmetric and gives a logical and structural support to the 3:2 ratio of neutrons to protons of this nucleus. Another symmetry of this structure is a periodic two alphas plus two neutrons (four protons, six neutrons, or two alphas per step). See Figure 6. For the radioactive heavy nuclei, we know there are four decay families, based upon (n, n+1, n+2, n+3) protons. Therefore, there is a natural structure of the heavy radioactive nuclei that repeats every four protons (and every six neutrons). The symmetry of both ^{234}U and ^{208}Pb give structural logic to the reason why there are four radioactive series. Also notice that the neutrons naturally extend beyond the protons.

At first glance the ^{234}U structure looks even more bizarre than that of ^{208}Pb . See Figure 4. It looks very unstable because of all the single bond sites, but as clarified above these are 1c sites with more stability than just the 1a sites. The additional stability comes from the flux coupling of the second-nearest-neighbor sites. A close look at these two structures will reveal that the ^{234}U structure is the square root of two times shorter than ^{208}Pb . This came about naturally and was not forced. This means that there is more proton repulsion in the ^{234}U than in the ^{208}Pb structure, and not just because it has more protons. In this respect ^{234}U is like a compressed spring. Because of its symmetry it is stable for long periods of time, but any break in this symmetry (like an alpha emission) is like a hair trigger that eventually causes the whole structure to deform and stretch out, taking on the final structures of the Pb nucleus (more stretched out). This is an interesting feature of this model.

A model of the nucleus must be able to explain nuclear excited states. Why should ^6He and ^6Be have only three known states?⁸ (Early references show that ^6He and ^6Be have only two known states and they should have the same number, since they were mirror nuclei.⁹) ^6Li , on the other hand, has six known excited states. Since all three nuclei have six nucleons, and the forces between nucleons are supposedly independent of the type of nucleon, a first approximation would expect these nuclei to have the same number of excited states. Complicated quantum mechanical models have attempted to explain the number of states for each of these nuclei. The CBM predicts that there should only be three excited states of ^6He and ^6Be and one is

obviously more stable than the other. See Figure 7. This model also naturally explains why ${}^6\text{He}$ and ${}^6\text{Be}$ are mirror nuclei. Notice by exchanging protons for neutrons, and visa versa, we transform one nucleus into the other. They both have the same structures. ${}^6\text{Li}$ being a nucleus with three protons and three neutrons has more possible configurations to arrange into nine shapes on a checkerboard, including a very unstable, and perhaps unfound, linear array of (p, n, p, n, p, n). Four of these nine structures are two sets of mirror nuclei. The number of excited states of other light nuclei also seem to agree with the CBM. CBM has not yet been developed enough to predict the value of the energy levels of these excited states.

Recent findings using the Gammaball (gamma ray energy detector) developed at Berkeley and Argonne have found that the y-rast excited states of many heavy nuclei have regular spacings. Equally spaced energy states seem to defy a simple explanation in QM terms. The nuclear physics community is at a loss to explain why these levels are equally spaced. As seen in the CBM, the large nuclei are spread out, similar to Pb, although some intermediate heavy nuclei have three helium structures per step. There appears to be a correlation between the number of steps in the CBM of the heavy nuclei and the number of these evenly spaced energy levels.

The nuclear force is sometimes considered to be a two pion exchange force, and the CBM suggests a justification of the two particle pion exchange force. Interestingly, the rest mass of 2π mesons is almost exactly the sum of the rest mass of the up and down quarks in this model (0.2% error).

During the 1970s and 1980s, in attempts to understand the existence of neutron stars, a number of quantum mechanical theories were developed that explained the structure of the nucleus as: semi-lattice, layered lattices (both 2- and three-dimensional), and the cluster models. Nucleon lattice structures have also been used to explain the break-up of large nuclei in multifragmentation studies. The theory and the data seem to agree, quite surprisingly. A review of this subject can be found in the work of N.D. Cook and D. Valerio, specifically their references 11-19.¹⁰ A detailed description of the layered lattice model can be found in R. Tamagaki.¹¹ These models not only explain the layered model in quantum mechanical terms but also explain the rationale for the neutron stars. A number of aspects of the CBM agree with these earlier models:

- 1) CBM assumes that the tensor force between nucleons is the primary component of the nuclear force and, therefore,
- 2) The pairing of the protons and neutrons is a result of oppo-

site orientated spin pairs of protons and neutrons, and

3) The alpha particle is the basic building block, having one spin up and one spin down, proton and neutron. The CBM deviates from some of these past works, since it is a two-dimensional model, not a three-dimensional model of the nucleus. CBM assumes that three-dimensional cubic structures are necessary to explain neutron stars.

There will be some skeptics of this model who will say this two-dimensional structure is unrealistic and not useful. In 1925 E. Ising published a paper using a simple one-dimensional model to explain ferromagnetism.¹² That paper led to the extension of this one-dimensional model into a two-dimensional model by L. Onsager¹³ in 1944, which has found great applicability and has opened up the theoretical field of low-temperature phase transitions. This work has been expanded upon by many other authors.¹⁴ Onsager's solution introduced the concept of correlation length, which has become very important to our understanding of the critical point in a phase transition. This was the one and only paper ever published by Ising. Ising, in many respects, remains unknown to most in the field of physics, yet to this day the concept of a systems critical point in a one-dimensional model is referred to as the Ising model. Therefore, new concepts even in one-dimension can eventually lead to a better understanding of the real physics of nature. Take, for another example, the concept of the quark itself.

The real beauty of CBM comes in its ability to explain the existence and stability of some of the very unstable nuclei. As just one example of the power of this model, the structure in Figure 8 would explain the existence of ${}^8\text{He}$, ${}^{11}\text{Li}$, ${}^{14}\text{Be}$, ${}^{17}\text{B}$, ${}^{20}\text{C}$, ${}^{23}\text{N}$, ${}^{26}\text{O}$, ${}^{29}\text{F}$, ${}^{32}\text{Ne}$, and ${}^{35}\text{Na}$. The first four of these isotopes along with ${}^6\text{He}$ and ${}^{12}\text{Be}$ are referred to as the halo isotopes, because the neutrons in these structures are known to be far out from the core of the nucleus, which results in the term halo neutrons. It is also known that the outer "two" neutrons are loosely bound to the core. When one considers the symmetry that CBM predicts, the above description fits, even though there are two loosely bonded neutrons on each end of the structures in Figure 8.¹⁵

In the case of ${}^6\text{He}$ and ${}^{12}\text{Be}$ this model would suggest that these structures have their two halo neutrons on "one" end of the structure. How else could both ${}^6\text{He}$ and ${}^8\text{He}$ be halo, each resulting in only "two" halo neutrons? One thing this model does not resolve is why experimentalists have not found ${}^9\text{Li}$ to be a single-ended halo structure, yet.

These two-dimensional structures also give approximately correct values for the radii of larger nuclei. The diameters of the flat plates that this model predicts are in good agreement with the diameters of a spherical nucleus, since the proton and neutron in this model are significantly smaller than the extrapolated values based upon spherical models (1.23 fm). These plates are similar to projections of a sphere onto a plane. For nuclei above Fe, the structures get elongated, and therefore a single number can no longer define the size of the nucleus. An approximate size (cross section) of these larger nuclei can be determined by calculating the two-dimensional area of protons and neutrons and converting the result into an effective diameter of the nucleus. This results in sizes that are, again, reasonably close to accepted values.

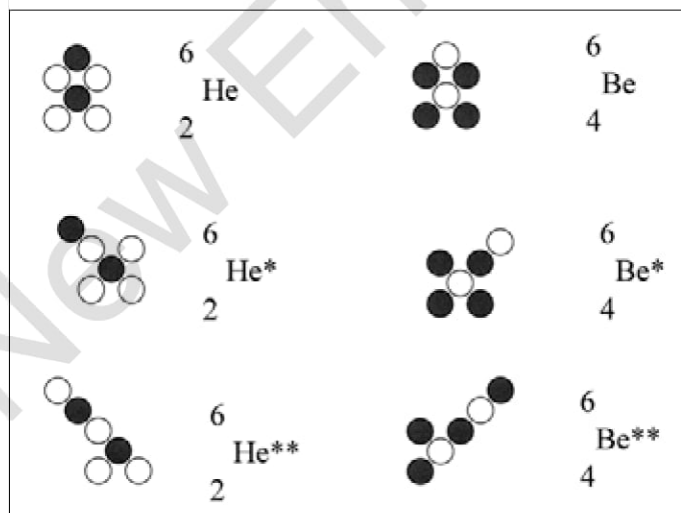


Figure 7. CBM proposed structure of excited states of ${}^6\text{He}$ and ${}^6\text{Be}$.

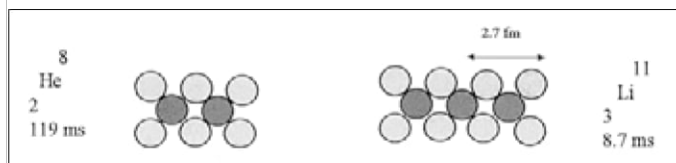


Figure 8. CBM proposed structure of the first two halo nuclei.

This model is the only one of the existing models that can suggest why linear alpha chains can exist. Evidence for linear alpha chains has been found all the way up to six alphas long, ^{24}Mg .¹⁶ The shell model, which relies on spherical structures, is at a loss to explain linear alpha chains. The liquid drop model does not do much better. The cluster model is the only model that can come close to an explanation. CBM has no problem with linear alpha structures, yet prediction of their stability, even in this model, is still not resolved.

CBM explains why the electron does not bond via the strong nuclear force to the nucleus. Since the electron is itself an elementary particle (point charge,) it cannot engage in interactions with the rotating quarks. Therefore, only rotating particles with three quarks can interact strongly with protons and neutrons.

Time and space prevent a discussion of all the structures that have been studied. However, one final structure of merit should be mentioned. If we look at the mirror nuclei of the halo structures, we begin to see a reason why a nucleus could become an emitter of two protons. If two protons were at the end of one of these structures, then their mutual repulsion would distort the position of the two end protons, leading to the breaking of the strong coupling of the tensor force, leading to two proton emission.

One final argument in support of this new model. This model predicts the rest mass of the up quark as $237.31 \text{ MeV}/c^2$ and the down quark as $42.392 \text{ MeV}/c^2$. These values definitely conflict with the current standard model, but do they have any redeeming qualities? If one enjoys symmetry, then the fact that the $2/3$ charged quarks in the other two generations are more massive than the $-1/3$ quarks, and may lead to a rational expectation that the up should be heavier than the down, and by a ratio similar to the ratio between the charmed and strange quark. A more significant observation is found regarding the mass difference between the $\Phi(1020)$ and the $W(782)$ mesons. Both these mesons are excited states of the π mesons, which are made of up and down quarks. These two mesons have all the same quantum numbers "0-(1,-1-)." They are the lowest excited states of the π meson, and therefore their masses are very precisely known. The currently accepted mass of the $\Phi(1020)$ meson is $1019.413 \pm 0.008 \text{ MeV}/c^2$, and the mass of the $W(782)$ is $781.94 \pm 0.120 \text{ MeV}/c^2$. The mass difference of these two mesons is $237.47 \pm 0.13 \text{ MeV}/c^2$. Notice that the lower limit of this difference ($237.34 \text{ MeV}/c^2$) is very close to the predicted mass of the up quark in this model ($237.31 \text{ MeV}/c^2$). Besides this example, there are other examples where the mass difference between excited states of the π mesons with the same quantum numbers appear to be related to either the values of $237.3 \text{ MeV}/c^2$ or $42.39 \text{ MeV}/c^2$ or multiples of these masses. Another example of this mass difference: eight times $42.39 \text{ MeV}/c^2$ is $339.14 \text{ MeV}/c^2$, which is the mass difference between two excited states of the eta mesons, $\text{Eta}(1295) - \text{Eta}(958)$, which have a current (1998) accepted difference of $339.2 \pm 2.9 \text{ MeV}/c^2$.

In summary, the model explains many of the properties of the nucleus. The basic premise of this model is that the stability of the nucleus is explained in terms of the electromagnetic force of rotating synchronized fractional charges. A semi-classical approach was taken to arrive at a ratio of the size of the proton and neutron using the structure of this model and the known magnetic moments of these two particles. The binding energy difference between the ^3He and ^3H was used to predict the radii of the proton and neutron using a linear structure of both of these nuclei. The relativistic speeds of the up and down quarks in this model were set to agree with the magnetic moments of the proton and neutron. The mass of the up and down quarks were determined using the standard Einstein relativistic mass equation to account for the known mass of the proton and neutron. These values were

refined so that the de Broglie wavelength of the up quarks in the proton exactly matched the circumference of the proton. The predicted size of the proton agrees adequately with published values based upon proton-proton scattering results. The negative peak in charge distribution within the neutron, based upon electron scattering, agrees with this model. Sample structures of stable and unstable isotopes are presented to add additional support to this model; only a few were discussed here, but many more have been analyzed. The CBM leads to a prediction of the rest mass of the up and down quarks significantly different from the standard model.

All new models need to make a prediction to test their validity. Experimental evidence of a negatively charged down quark at the center of the proton with mass equal to $42.392 \text{ MeV}/c^2$ would add credibility to this model. Since recent data from the Deutsches Elektronen-Synchrotron's (DESY) HERA accelerator have found an apparent hard core in the center of the proton, this prediction may soon be verified. Both the ZEUS particle detector and the H1 particle detector at the DESY's HERA accelerator have found significantly more hard hits from the center of the proton than the standard model can explain.¹⁷ This accelerator uses positrons as the probing particle. Since the positron is positively charged, one might expect more collisions with a negatively charged down quark in the center of the proton. If the mass of this hard core can be determined and turns out to be near $42.4 \text{ MeV}/c^2$, this would add significant support to this model.

References

1. Krane, K.S. 1987. *Introductory Nuclear Physics*, Wiley & Sons, New York, 80.
2. Blin-Stoyle, R.J. 1991. *Nuclear and Particle Physics*, Chapman & Hall, London, 13.
3. Landau, L.D. and Smorodinsky, Y.A. 1993. *Lectures on Nuclear Theory*, Dover, New York, 28-33.
4. Asimov, I. 1992. *Atom: A Journey Across the Subatomic Cosmos*, Truman Talley Books, New York, 255-258.
5. Blatt, J.M. and Weisskopf, V.F. 1979. *Theoretical Nuclear Physics*, Springer-Verlag, New York, first published by Wiley & Sons, New York, 1952, 204-212.
6. Yang, F. and Hamilton, J.H. 1996. *Modern Atomic and Nuclear Physics*, McGraw-Hill, New York, 686-687.
7. Gottfried, K. and Weisskopf, V.F. 1986. *Concepts of Particle Physics*, Volume 2, Oxford University Press, New York, 283.
8. Williams, W.S.C. 1991. *Nuclear and Particle Physics*, Clarendon Press, Oxford, 170.
9. Sherrill, B.M., Morrissey, D.J., and Davids, C.N., 1998. eds. ENAM (Exotic Nuclei and Atomic Masses Conference) 98, AIP New York, June, 404.
10. Cook, N.D. and Valerio, D. 1987. "Face-Centered-Cubic Solid-Phase Theory of the Nucleus," *Phys. Rev.*, **C35**, 1883.
11. Tamagaki, R. 1979. "Solid-Like Aspect with Alternating-Layer-Spin Structure and Pion Condensation in a Nuclear Medium," *Nuclear Physics*, **A328**, 352.
12. Ising, E. 1925. *Zeitschrift. f. Physik*, **31**, 253.
13. Onsager, L. 1944. "A Two-dimensional Model with an Order-disorder Transition," *Phys. Rev.* **65**, 117-149.
14. Thouless, D. 1989. "Condensed Matter Physics in Less Than Three Dimensions," Chapter 7 of the *New Physics*, edited by Paul Davies, University Press, Cambridge, 209.
15. Poenaru, D.N. and Greiner, W. 1996. *Handbook of Nuclear Properties*, Clarendon Press, Oxford, 103-104.
16. Wuosmaa, A.H. et al. 1992. "Evidence for Alpha-Particle Chain Configurations in ^{24}Mg ," *Physical Review Letters*, **68**, 9, March 2, 1295.
17. Glanz J. 1997. "Deep Within the Proton, A Flicker of New Physics," *Science*, **275**, 1266.

About the Author



Ted Lach is a distinguished member of the technical staff at Bell Labs. He has been with AT&T/Lucent Technologies for over thirty years. He obtained both a B.S. and an M.S. in physics from the University of Illinois. He also holds an M.S. in material science from Northwestern University.
*433 Roe Court, Downers Grove, Illinois 60516;
e-mail: tlach@lucent.com



The Future of Palladium (and Palladium Futures)

Les Case*

The recent very sharp increase in the price of Pd has brought into public focus a situation which has been developing for some few years.

Palladium is that Pt-group metal of largest production (although notably in some South African mines, the production of Pt predominates). About six million ounces of Pd are mined each year, with mining capacity currently and contemplatively in increase, because of the giant price rises. The largest producer of Pd is Norilsk Nickel, which produces very roughly one-half of the world's supply as a by-product from its nickel mine in northern Siberia. The only U.S. producer, and indeed the only large mine which produces primarily palladium, is Stillwater Mining, in Montana.

For many years (since about 1965), Norilsk produced more Pd than could be used, and the excess went into a secret government stash, which at one point reached probably about twenty to thirty million ounces. While the Pd was in considerable excess supply, the price fluctuated at about \$100 to \$150 per ounce, quite a bit lower than that of gold and platinum.

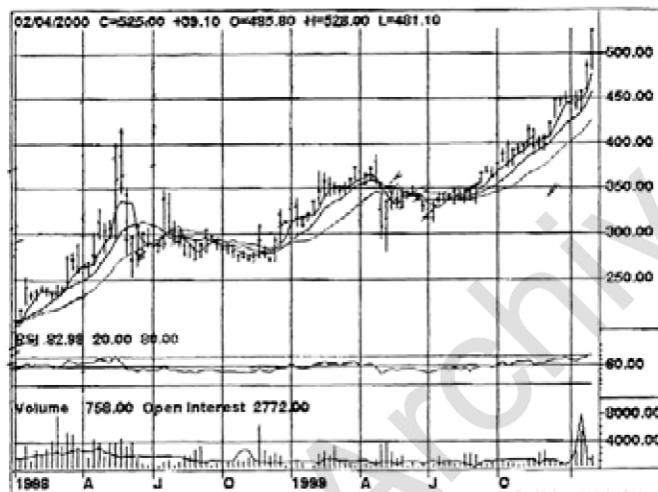
Pd has had several specialized uses (none very large), such as dental construction, electronic resistors, catalysts for various chemical applications, and even jewelry. (Pd has been used in Japan as a cheaper substitute for Pt in jewelry and the preferred 18K white gold is 25% Pd.)

Several years ago, a giant new use developed for Pd, which has changed everything. It was decided that autos had to clean up their exhaust gases, notably in unburned hydrocarbons, which cause smog and pollution. The easiest way to do this was with Pt-group metal catalytic converters, the most effective of which is Pd bearing. Thus, each car uses about one-fifth of an ounce of Pd. This market has grown rapidly over the last few years and now used very nearly all Pd mined each year. Until about the first of this year, the Russians had been supplying the difference between Pd demand (now about eight to nine million ounces) and Pd production (about five to six million ounces) from their stash. But supplies from that stash have now apparently about dried up. The Pd price rose above \$250 per ounce in about April 1998, above \$400 about last November, and is now about \$700 an ounce, having briefly gone above \$800 in late February.

The situation existing today is that auto emissions catalysts use up almost all of the mined Pd, and that demand is even still growing. There is no Pd left for the other users. The auto companies can afford a still much higher price in order to sell autos, so a bidding war for Pd has erupted. A price well above \$1000 per ounce looms in the near future, and the price to be reached later this year could easily (but probably temporarily) be in the thousands of dollars, rather than hundreds of dollars, per ounce. The price on the commodity exchange is extremely volatile, with a recent short squeeze apparently having taken place, followed by exchange-forced liquidation of long positions. This market action has been mind boggling.

The only realistic long-term solution is a replacement of Pd auto emission catalysts, and other Pt-group metal catalysts (Pt, Rh, etc.) cannot suffice, because they are in even shorter supply. We will have to see and use lighter autos, smaller engines, intrinsically cleaner engines, etc. Pd is much too valuable in other very important catalytic applications to be wasted in controlling auto emissions, which can be otherwise controlled. [Editor's Note: These "other very important catalytic application" are none other than catalytic fusion processes. —EFM]

TFC Commodity Charts Palladium (NYMEX) Weekly Price Chart



Graph from website: <http://tfc-charts.w2d.com/printchart/PA/W>

In late February, the Tokyo Commodity Exchange issued a rather confusing order attempting to set the price of Pd at just about \$700 per ounce. Since then, the price worldwide has indeed stabilized at that point. If the price continues to stay there, obviously something is going on. One possible explanation is that the Russians, who have been threatening imminent exports, have indeed sent some quantity to Tokyo, under an agreement that all sales will be at \$700. This would translate into a big profit for the Russians (and also Stillwater Mining), would supply the market at a steady (though very high) price, and allow the Japanese a small profit while keeping their auto industry at work and exporting. Such an agreement could stay valid only as long as the supply satisfies the market demand, probably for a few weeks to a few months.

Obviously, if the price remains pegged, it is not a time to be playing the futures market for swings, and I contemplate getting out.

The catalytic fusion work of Les Case has been featured in *Infinite Energy* Issues No. 19 (pp. 32-40) and No. 23 (pp. 9-15). The "Case cell" is under continued testing and is often discussed in the "Device and Process Testing Update" column written by staff at the New Energy Research Laboratory.

*P.O. Box 495, Greenland, NH 03840



21st CENTURY SCIENCE & TECHNOLOGY

Winter 1999 - 2000 Features

- The Swindle of Special Relativity by *Laurence Hecht*
- The Singing Voice Demands $C = 256$ Hz by *Kathy Wolfe*
- Champollion and the True Story of Egypt
by *Muriel Mirak Weissbach*
- Barry Fell, Epigrapher: Biography of a Renaissance Man
by *Julian Fell*
- The Global Warming Folly by *Zbigniew Jaworowski*

Subscribe! \$25 for 6 issues (U.S.)

\$50 for 6 issues (foreign); Single copies \$5 (\$6 foreign)

Send check or money order (U.S. currency only) to
21st Century, P.O. Box 16285, Washington, D.C. 20041

Tornadoes and Ball Lightning

Edward Lewis*

Editor's Note: In this article we learn of remarkable luminous phenomena, documented by eyewitnesses, that are associated with tornadoes. The possible linkage with ball lightning is of great interest, since ball lightning itself is a mysterious phenomenon that is still under investigation (see *Infinite Energy* 25, pp. 12-20). Though the author draws what some may regard as tenuous comparisons among disparate phenomena, we believe that our audience will be interested in the reported phenomena as well as the proposed associations.—EFM

Abstract



The purpose of this article is to show evidence for identifying tornadoes and ball lightning to be different sizes of the same general kind of phenomena. Certain anomalous characteristics of tornadoes and ball lightning are described and shown to be similar. There are anecdotal reports of ball lightning that were similar to whirlwinds and of very brightly shining and very hot tornadoes. Recent evidence from discharge experiments, which produced microscopic ball lightning, is also discussed to further explain characteristics of ball lightning and tornadoes.

This article contains striking accounts of luminous tornadoes. There are many reports of luminous tornadoes, including reports by people who have been inside tornadoes or seen into them from underneath. Those who have seen them from the inside or underneath report bright clouds, or light, or that the funnel was bright inside from much continuous lightning which "zigzagged" from side to side inside.^{1,2} According to Dessens, who catalogued tornadoes in France, about one-half of the tornadoes that he catalogued were either "furrowed by lightning, or the bottom of the tornado expels balls of fire, or, in short, the tornado is luminescent at one place or another."³ Ball lightning is another luminous atmospheric phenomenon that sometimes exhibits vortex or whirlwind activity. In order to identify phenomena, people look for similarities and evidence of interconversion. The similarity of phenomena is evidence of the identity of phenomena. Intermediate phenomena is also evidence of identity, and the interconversion of phenomena is proof of the identity of phenomena. Evidence from recent experiments which produced microscopic ball lightning help to explain the behavior of tornadoes and ball lightning. The purpose of this article is to show evidence for identifying tornadoes and ball lightning as different sizes of the same general kind of phenomenon.

Reports of Atmospheric Luminescent Whirlwind Phenomena

Here are some striking reports:

F. Montgomery, weather observer for the U.S. Weather Service was stationed in Blackwell, Oklahoma, in May 1955, reported a tornado that passed by at 9:27 p.m.⁴ It had a deep blue section that was near the cloud layer and it was "very much brighter" than an arc welder—too bright for him to look at, though the tornado was nine blocks, or 3,600 feet, away from him. I suspect that the bright section may have been toroid-shaped. He reported that the air from the tornado felt hot and that the temperature, as recorded by a thermometer at his instrument shelter, rose from 74 to 80°F when the storm struck. This is evidence of a spectacular rate of radiation. He reported:

There were rapidly rotating clouds passing in front of the top of the funnel. These clouds were illuminated only by the

luminous band of light. The light would grow dim when these clouds were in front, and then it would grow bright again as I could see between the clouds. As near as I can explain, I would say that the light was the same color as an electric arc welder but very much brighter. The light was so intense that I had to look away when there were no clouds in front. The light and the clouds seemed to be turning to the right like a beacon in a lighthouse.⁵

According to a drawing of this tornado in an article by B. Vonnegut and J. Weyer, the tornado was conical shaped, pointed downward, and the bright section of the tornado was 100 feet thick, about 800 feet above the ground, and about 400 feet wide.⁶ Montgomery also reported that a few minutes after the storm passed, there was a taste and smell in the air like that of burnt sulphur, the air was clammy, and hard to breathe. Lee Hunter saw this same tornado a little later, four miles north of Blackwell, Oklahoma. He reported:

The funnel from the cloud to the ground was lit up. It was a steady, deep blue light—very bright. It had an orange color fire in the center from the cloud to the ground. As it came along my field, it took a swath about 100 yards wide. As it swung from left to right, it looked like a giant neon tube in the air, or a flagman at a railroad crossing. As it swung along the ground level, the orange fire or electricity would gush out from the bottom of the funnel, and the updraft would take it up in the air causing a terrific light—and it was gone! As it swung to the other side, the orange fire would flare up and do the same.⁵

So it seems that the entire funnel became luminescent. The deep blue band of light that Montgomery saw was not intrinsically different from the rest of the funnel. It also seems that the tornado was layered.

This particular tornado developed from a thundercloud that had a large, blinking circular pale blue spot that H. Jones⁷ saw about one hour earlier. It emitted electromagnetic radiation that Jones recorded using sferics storm tracking equipment in his laboratory. This phenomenon was also tracked on radar. I suspect that the pale blue spot was a large ball lightning inside the cloud, and that it may have been blinking due to clouds rotating inside, just as Montgomery reported. I suspect that it was pale blue because it was seen through a cloud instead of directly as Montgomery saw it. Jones reported that the pale blue spot was continually blinking on for two seconds and then off for two seconds. I've seen movies that showed rotating lighthouse lights. They would seem to light for two seconds and be dark for two seconds. So Montgomery's statement about the rate of turning like that of a beacon lamp on a lighthouse may match Jones' statement about the rate of blinking. According to many reports and even pictures in books (see my other articles on website*), ball lightning may blink or even be dark for as long as it is observed. Jones also reported that during the tornado there were lightning strikes occurring at a rate ranging from two to twenty-five per second,⁸ which is very much higher than the rate of strikes in thunderstorms. So there is much evidence that the blue ball lightning in the cloud developed to be the blue tornado.

Jones also reported seeing and tracking other blue lights⁸ in clouds that he called "tornado pulse generators" at other times. He wrote that they are not visible during the daylight hours. He wrote that the "pulse generator" may develop and remain active without subsequent tornado development. Reports of tornadoes like these seem similar to reports of large bright toroidal ball lightning-like objects, tens of meters across, that

were associated with air or water vorticity like tornadoes.

Structures in clouds such as the ones seen by Jones are probably common. In a book about the "Bermuda Triangle," *The Devil's Triangle*, there is a drawing of a typical cumulonimbus cloud courtesy of the Aviation Training Division of the U.S. Navy. The drawing diagramed a typical cumulonimbus cloud structure, and in this diagram there is shown a black spot drawn in the base of the cloud, below the altitude of freezing, which was termed a "dark area." It is roughly similar in size, shape, and position relative to the rest of the structure of the cloud as are the blue spots in the clouds drawn by Jones, shown in his article. I suspect that these phenomena are the same thing. Perhaps like some ball lightning, these structures in clouds may also be dark, or blink on and off. The "dark spot" in that diagram was shown to be just behind the roll cloud.

Vonnegut and Ryan even photographed two luminous tornadoes.⁶ The original negative of this photograph was analyzed⁹ using equipment called an isodensitracer. B. Thompson and R. Johnson did a densitometric study and concluded that "the luminous pillars constitute a genuine exposure and are not an artifact of either exposure or development." In fact, they pointed out certain features that seem to me to be features of luminous tornadoes.

Even if tornadoes are not glowing, this may be because they are shielded by clouds or debris, or maybe the tornado is radiating at frequencies that people can't see. Perhaps the sides of many or most tornadoes are opaque or not very translucent. Since in the U.S. most luminous tornado experiences happen at night, though nighttime tornadoes in the U.S. are relatively uncommon, perhaps the luminosity is more noticeable at night. Many of the pictures of tornadoes that I have seen show that the tornadoes are white, even though the sky is overcast and dark. This may be evidence of luminosity that people have never noticed before. R. Jackson once was also inside a tornado,¹⁰ and he reported a "white column" and that it "became light" inside.

More Evidence of the Identity of the Phenomena

Tornadoes and ball lightning seem to be the same phenomenon, though the size varies.¹¹ If a phenomenon converts to another phenomenon, they must both be manifestations of the same general kind of phenomenon. People have seen intermediate forms, the conversion of large ball lightning-like phenomena to tornadoes, and the emission of many ball lightnings by tornadoes. There are many reports that luminous ball lightnings break away from the bottom rims of tornadoes or that they are seen to emerge from the bottom. This phenomenon is similar to the phenomenon of small tornadoes forming and breaking away from the bottom of tornadoes. People have seen small dust devils or whirlwinds that were luminescent, and very large luminescent toroidal ball lightnings that were like tornadoes. For example, as reported in the *Monthly Weather Review*, in Americus, Georgia, on July 18, 1881, at some distance from the town:

... a small whirlwind, about five feet in diameter and sometimes 100 feet high, formed over a corn field where it tore up the stalks by the roots and carried them with sand and other loose materials high into the air. The body of the whirling mass was of vaporous formation and perfectly black, the center apparently illuminated by fire and emitting a strange "sulphurous vapor" that could be distinguished a distance of about 300 yards, burning and sickening all who approached close enough to breathe it. Occasionally the cloud would divide into three minor ones, when the whole mass would shoot upwards into the heavens.¹²

This whirlwind divided into smaller whirlwinds and rejoined. This is similar to the reported behavior of many ball lightning phenomena, and also similar to the behavior of tornado phenomena. In his description of this particular whirlwind, W. Corliss wrote, that it was "almost a meteor/tornado/ball lightning hybrid."¹³

An example of a very large luminescent toroidal ball lightning that was like a tornado: the Silverton, Texas, tornado of May 15, 1957, during which twenty people died, was observed by a resident of the town who reported a round light in the form of a ring that was about forty or fifty feet above the ground and forty or fifty feet in diameter.¹⁴ He said that the lightning came up from the ground and corkscrewed around to join the ring and went up into the cloud. Intermediate phenomena may be evidence of identity of phenomena which people have thought were disparate. The inter-conversion of phenomena is proof of the identity of phenomena.

Both tornadoes and ball lightning¹⁵ are associated with anomalously high energy output. Both have been reported to scorch the ground or vegetation. Montgomery reported that vegetation along the path of the Blackwell tornado was wilted or looked burned and that the tornado "dried the ground." Both ball lightning and tornadoes are associated with considerable electricity. Some ball lightnings constantly discharge electricity. By measuring the change of the Earth's electric and magnetic field in the vicinity of a tornado, some tornado researchers¹⁶ have estimated that tornadoes are associated with a steady current of hundreds of amperes for minutes at a time. This would be hundreds of times more than the electrical output of a thunderstorm. This high output of electricity and light suggests energy production. Electrical discharges from tiny plasmoids are also shown by the micrometer sized plasmoid marks produced by T. Matsumoto¹⁸ and V. Nardi and W. Bostick.¹⁷

Plasmoid Phenomena Produced in Apparatus

In many articles about cold fusion produced by electrolysis and discharge, Matsumoto has shown many kinds of anomalous micrometer-size traces that appear to be marks of objects that behave like ball lightning and plasmoids. Matsumoto has accepted my idea of tiny ball lightning, and he thinks my ideas about plasmoids for cold fusion are right. The traces Matsumoto has produced show that the plasmoids exhibit various anomalous behaviors like ball lightning, such as hopping and skimming; passing through glass, water, and air; and emitting beams and sparks. The traces also show that the plasmoids are shaped and structured like ball lightnings.

Ball lightning and tornadoes may move along a surface, such as the ground, and leave trails, holes, or furrows. The plasmoids K. Shoulders produced did so too, and Matsumoto has shown pictures of interesting micrometer-size trail marks that meander and even backtrack on plastic sheets. Tornadoes are often reported to leave furrows in the ground a few inches or several feet deep which may sometimes be more than a mile long.¹ Matsumoto has also shown ring traces of the same size combined together in one place¹⁸ (see Figure 1) that are due to a toroidal or cylindrical plasmoid repeatedly hopping up and down and skimming on one spot of a nuclear emulsion (a very thin sheet of acrylite plastic). The microscopic ball lightnings leave markings in plastic that look much like the markings that tornadoes leave on the ground.

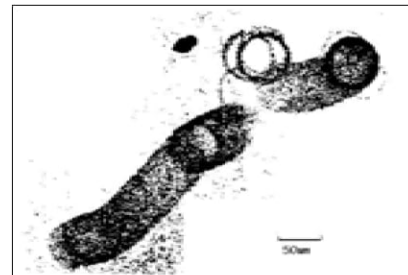


Figure 1. Tornado-like trail and hopping marks left on a sheet of Acrylite plastic by a toroidal or cylindrical microscopic ball lightning phenomena.¹⁸ This ball lightning marking was produced through electrical discharge in water and shows a combination of tornado behavior and ball lightning behavior. The plasmoid passed through water, glass, and air to reach the plastic sheets.

Conclusion

In summary, there

Lewis continued on page 67

Technical Note

Suggestions for Improving the Amin Cycle

Ronald D. Pearson
Somerset, England

Andrew Wyon and myself were astonished by Ken Rauhen's article (IE No. 29, pp. 49-51) claiming that the Amin cycle is able to defeat the second law of thermodynamics, and I make two helpful suggestions. I have investigated many proposals aimed at second law violation but have had little difficulty in finding fallacies so far. Consequently, I felt it would be easy to show that, even in the ideal case, more power would need to be supplied to the fan, to speed up air, than would be recovered when the fan was stopped.

The cycle is a piston and cylinder arrangement in which an enlarged cylinder head contains a fan. The outward movement of the piston gives the power stroke with the fan stopped. Then the fan is sped up to maximum revs so that some air is sucked out of the cylinder and stored near the fan blade tips. This means that on the return stroke the pressure against the piston is reduced, so yielding a net output from the piston in a complete cycle. It can be arranged that no air is left in the piston space at the end of the return stroke so that all the air is now contained in the vortex. (The simplest case to analyze.) It is crucial that all the ideal power put in to create a forced vortex is recovered by stopping the fan before commencement of the next power stroke.

To my astonishment, I found that the ideal input to the fan is exactly equal to that subsequently recovered, so that, for the first time in my life, I was totally unable to flaw the logic!

However, the limitations, for practical application, are the huge accelerating and decelerating torques needing to be applied to the fan, especially when noting that the tip speed needs to approach the speed of sound to obtain a significant pressure differential. This makes air a totally unsuitable working fluid. Our first proposal, therefore, is that a refrigerant of the highest possible molecular weight be tried in the existing apparatus to make the speed of sound as low as possible. Refrigerant C318, Octafluorocyclobutane, having a specific volume of 1.54 ft³/lb for vapor and .01 ft³/lb liquid at 25°F 15.93 psia is probably the most suitable. (I could have let you have some R14 if you had been in England.) Any reduction in power input would help prove the case.

There is little hope of a net output using the existing apparatus, however, since fan friction and blade leakage mean that the actual fan power input will always greatly exceed that recovered. To eliminate this, the entire cylinder, fan casing, and fan blade assembly needs to be made in one piece and rotate as a complete assembly. The whole needs to be from carbon fiber composite to minimize the moment of inertia. (It needs a layer of aluminum foil for sealing, as the composite is likely to leak a little.) Condensation of the refrigerant at the outer radius can be utilized to minimize volume and weight of the fan-casing unit. The whole outside casing ought to be run in partial vacuum to minimize friction using a seal from "rulon" at the piston rod.

As a final note: some people have advocated the Peltier effect, the solid state version of a thermocouple, as being a potentially over-unity device. This is definitely not true. Even with all heat conduction losses eliminated, heat is rejected at the cold junction owing to contact potential having to be overcome. Indeed, it is easy to show that under this condition the Carnot efficiency would obtain. Nor can the gravity of planets produce a "Maxwell's demon." When the velocity distribution is taken into account, exactly the same distribution and temperature is found to apply to all levels in the field when the mean free path is large compared with the width of the energy bar-

rier. This is why a vapor has the same temperature as the liquid from which it is evaporated.

Ken Rauhen Responds:

Thank you for your comments. I have forwarded this information to Mr. Amin. I find your comments on the Amin cycle enlightening. Related to the speed of sound is density. Increased density allows a comparable pressure differential to be created with less rotational speed.

I disagree with the two items in the final paragraph of your letter. The comments about solid state behavior are unclear. It sounds like you are talking about conventional thermocouple circuits which, of course, are Carnot-limited due to the presence of reversed junctions. The analysis of a single junction of either polarity shows unity conversion, though. Lacking clarity and specific detail from your response, I uphold my position.

The second item about celestial body atmospheric Maxwell's demons being invalid is also not clear, lacking detail to support the counterclaim, and it lacks evidence of error in Steinmetz's math (IE No. 26, p. 20).

—Ken Rauhen, Senior Research Scientist
New Energy Research Laboratory

□□□

Lewis continued from page 66

is a lot of evidence for identifying ball lightnings and tornadoes as different sizes of the same general phenomenon. Also, plasmoids that are like microscopic ball lightnings are identifiable with tornadoes. Since the ball lightning-like plasmoids are associated with transmutation and excess energy, we might also expect that tornadoes would be too.

References

1. Justice, A.A. 1930. "Seeing the Inside of a Tornado," *Monthly Weather Review*, 58, May, 205.
2. Flora, S. 1949. "The Nature of Tornadoes," *Weatherwise*, 2, 2, April, 27.
3. Dessens, J. 1965. *J. Rech. Atmos.*, 2, 91.
4. Moore, C. 1956. "Some Observations on the Tornado at Blackwell, Oklahoma 25 May 1955, Reported by Floyd C. Montgomery...", *Weatherwise*, 9, 3, June, 97.
5. Vonnegut, B. and Moore, C.B. 1957. "Electrical Activity Associated with the Blackwell-Udall Tornado," *Journal of Meteorology*, 14, June, 284.
6. Vonnegut, B. and Weyer, J. 1966. "Luminous Phenomena in Nocturnal Tornadoes," *Science*, 153, September, 1213.
7. Jones, H. 1965. "The Tornado Pulse Generator," *Weatherwise*, 18, 2, April, 78.
8. Jones, H.L. 1955. *Research on Tornado Identification* (3rd Quart. Prog. Rep., Contract No. DA 36-039 SC 64436), Stillwater, Okla. A. and M. College, 8-35.
9. Thompson, B. and Johnson, R. 1967. Letter, *Science*, 155, January, 29.
10. Jackson, R. and Bigler, S. 1958. "Inside the Texas Tornado," *Weatherwise*, 11, 3, June, 88.
11. Lewis, E. 1994. "Luminous Tornadoes and Other Plasmoids," *Cold Fusion Times*, 1, 4, Winter, 4.
12. 1881. *Monthly Weather Review*, 9, 6, July, 19.
13. Corliss, W. 1986. *Handbook of Unusual Natural Phenomena*, Arlington House, New York.
14. Vonnegut, B. and Moore, C. 1958. "Giant Electrical Storms," *Proceedings of the Second Conference on Atmospheric Electricity*, May 20-23, Portsmouth, New Hampshire.
15. Egely, G. 1988. "Physical Problems and Physical Properties of Ball Lightning," *Proc. First International Symposium on Ball Lightning (Fire Ball)--The Science of Ball Lightning (Fire Ball)* July 4-6, Tokyo, Japan.
16. Brook, M. 1967. "Electric Currents Accompanying Tornado Activity," *Science*, 157, September 22, 1434.
17. Nardi, V., Bostick, W., Feugeas, J., and Prior, W. 1980. "Internal Structure of Electron-Beam Filaments," *Physical Review A*, 22, 5, November, 2211.
18. Matsumoto, T. 1995. "Artificial Ball-Lightning: Photographs of Cold Fusion," manuscript dated January 17, 1995 presented at ICCF-5, April 9-13, Monte Carlo, Monaco.

*Box 2013, Champaign, IL 61820; e-mail: elewis1@hotmail.com
<http://www.geocities.com/CapeCanaveral/Lab/4946>

Copyright © 2000

□□□

Feuds continued from page 47

same. (Case in point: As recently recorded in this magazine, Professor George Miley was deprived of his already-awarded government grant to do cold fusion-related research by the counterattack of academic plotters working anonymously—in the blind service of their dogma—through government committees.)

Other nuggets can be mined from the same vein: Galileo was inhibited from mounting an all-out attack on the Ptolemaic (epicyclic) version of astronomy by its manifest invulnerability, which was ensured by the fact that “the Ptolemaic theory is an integral part of a complex, complete system: science, philosophy, and religion all rolled into one.” Could words more aptly describe the social status of today’s invulnerable Einsteinian “relativism”? Finally, to choose at random another thought-provoking topic, in referring to Galileo’s famous tripartite *Dialogue*, the author remarks that “he lets Simplicio sum up the Catholic Church’s position concerning the impossibility of obtaining true knowledge of the physical world.” Though I am no Catholic, I could readily subscribe to this type of humility as an ideal moral guide for all science in all times. It is a pity that it does not spring directly from the hearts of scientists, rather than being (ineffectually) imposed by an outside authority that speaks for and from ignorance.

Incidentally, although I have not read Galileo for many years, my recollection of the *character* of the three disputants in his dialogues does not quite fit the stereotype suggested here and in other modern readings. To me, Simplicio speaks not for dogmatic ignorance but for open-minded ignorance—quite a different affair—and it is Sagredo, the voice of authority, who is committed to academic cant or political correctness, not at all in general what Galileo himself believes. The game in these dialogues is for Salviati (whom I identified more directly with Galileo’s own opinions), over Sagredo’s erudite obfuscations (reason over authority), to persuade the *man in the street*—namely, Simplicio. The latter is the lynchpin. The whole motivation and objective of the dialogues is the changing of the opinions of Simplicio—who is never the spokesman of an academic “party line” or of church authority but simply of popular misconception. Simplicio is neither stupid nor simple, just misinformed. In other words, he is not a scientist, but at best an avid reader of *Science News* and *Scientific American*. Sagredo, on the other hand, is an academic scientist of the sort often asked to write for *Scientific American*. Salviati is never asked and has to publish his own book. Or so I saw it, but am prepared to find myself as usual out of step with accepted scholarship.

I perceive that my background of bias toward physics has caused me to over-emphasize that discipline. Other sciences are represented here as well. There is even something for mathematicians, in the “feud” of Wallis versus Hobbes—the latter having rashly claimed success in the then-popular mathematical pastime of “squaring the circle.” One gets nice glimpses of the personalities involved in these quarrels. That immensely improves the readability and entertainment value of the material. . .but perhaps contributes noise to hide any signal present? Henry Ford said that “history is the bunk.” One can sort of see what he meant, in reference to micro-history of the “factual” kind that can never recur until water boils on a cold stove. If you seek from this book lessons that reach beyond the sphere of enjoyable entertainment, you will have to contribute most of them through your own capacity for insight.

□□□

Voodoo continued from page 45

appalling and have nothing to do with the serious scientific investigation of anomalous energy phenomena. And Park states that “there is now overwhelming scientific evidence that we ourselves can affect Earth’s climate.” Some scientists would agree with that; I don’t happen to. I side with those atmospheric scientists who believe that computer models do not yet come close to an adequate representation of all the factors that affect climate.

On the other side, Park is rather forgiving about such things as government spending for tokamak hot fusion, which is widely regarded as a financially wasteful research boondoggle even by those who have nothing to do with cold fusion. He says absolutely nothing about the ill-fated Superconducting Supercollider (SSC), which was begun and then cancelled, before it could waste even more taxpayer money. We do not hear of the scandalous recent cost overrun at the ICF weapons simulation laser fusion device, which was led by a physicist who was not even honest about his academic credentials. To Park, this waste is apparently “all in the family”—the kind of money that the white collar welfare, government-funded physics community can be forgiven for wasting.

It is tempting to speculate that Park may be suffering from a psychological problem known as *projection*, or possibly *cognitive dissonance*. At some level, this confused man with all his years of schooling must realize that he is out of his element in evaluating the cold fusion evidence. He doesn’t really know whether the evidence is good or not. Obviously he has not studied it except superficially, yet he has gone far out on a limb in attacking it—he can’t bring himself to turn back. Among other problems, admitting he had been very wrong would call into question his many other judgments, from manned space travel to magnet therapy. He expected that cold fusion would have gone away years ago, but it hasn’t. So he creates the myth that the cold fusion field consists of “followers who see what they expect to see.” In truth, it is Park who is seeing what he wants to see—lack of evidence where there is evidence! The following grand assessment by Park of “voodoo” *others* pertains most properly to *him*: “While it never pays to underestimate the human capacity for self-deception, they must at some point begin to realize that things are not behaving as they had supposed.” It will be cosmic justice for this profoundly foolish, mean-spirited flack for the physics establishment when in the light of scientific advance the bigotry and lies he has turned against others expose him for what he is.

□□□

Voices continued from page 46

the thousand year cycle of increased meteor activity is the true basis for pre-millennial tension. That it wasn’t just the dinosaurs who suffered, but almost every catastrophe, local or global, throughout history is in some way linked to the after effects of meteoric impacts.

This denouement may sound a little glib and easy, but Schoch’s journey towards this conclusion is neat and believable and can only be fully appreciated by a reading of the entire book.

In summary, he refers back to the nature of the prevailing wisdom and suggests that we shouldn’t forsake our roots or “the knowledge that appears to have become buried with the ancients”; that we need to regain our “sense of the world” and that “in waking up to the new paradigm, we recover something long lost, something very old in ourselves.”

□□□

Why was cold fusion such a will-o-the-wisp occurrence? I have a theory that may explain it. There are at least four ways to produce fusion of hydrogen into helium. The first is the natural method used in stars using gravitational high pressures. Attempts to scale this method down to reactor size in the United States and Russia have so far been unsuccessful. Another method uses mechanical compression of hydrogen most easily obtained with a high explosive implosion assembly. The third method involves muon shielding, replacing the hydrogen electron with a much heavier muon. This has been accomplished at the Los Alamos Meson Facility and other accelerator laboratories, as witnessed by the detection of 15 meV neutrons. The fourth method is the cold fusion reactor absorbing hydrogen into palladium where it is precompressed.

Nuclear physicists have calculated that the 800 times compression of this method is marginal and may need some assistance. Squeezing the palladium mechanically will help, but it is not very practical for a power reactor. That leaves combining palladium compression with muon shielding. As far as I can tell, both methods have been used separately with disappointing results, but have never been intentionally used together. If Jones of BYU, who used muon shielding, and Pons and Fleischmann, who used the palladium method, had stopped competing and collaborated, they might have tried this.

A muon generator is massive and expensive, but so are the Stellerators, Tokamaks, Z machines, and high-powered laser compressors now being tried. There is another way muons are generated and that is in a cosmic particle shower. Could it be that successful operation of cold fusion reactors only coincided with cosmic particle showers? Cosmic particle activity is a function of latitude increasing with distance from the equator. It may be worthwhile to dust off a few of those old cold fusion reactors and try them in a beam of muons.

Sure, the lifetime of muons in free space is very short, but so is the lifetime of free neutrons. In a nucleus, it may be indefinite. Even a muon replacing the hydrogen electron in a hydrogen atom may live longer and when confined in the palladium lattice, who knows how long it can survive?

Dan C. Harrington
Fridley, Minnesota

Editor's Note: You bring up some excellent observations, but I'm afraid that waiting around for cosmic rays to bombard a particular Pd-heavy water cold fusion experiment or finding a ready and willing source of muons is not in the cards. There are more reliable and simpler methods that are being explored at this time, such as various thin-metallic film approaches, Pd-black, or catalytic fusion with Pd-on-carbon. —EFM



Electrifying Times

Latest Electric Car News

Only \$12.00* per year
for 3 issues.

The only periodical in America with newsstand distribution covering the fast growing world of EV's and HEV's.

63600 Deschutes Market Road
Bend, Oregon 97701
Phone: (541) 388-1908
Fax: (541) 388-2750
Website: www.electrifyingtimes.com
E-mail: etimes@teleport.com

*\$18.00/yr Canada; \$21.00/yr International



Limited Edition CD! Antigravity • Cold Fusion • Ball Lightning

- Theory
- Stories, reports
- Pictures taken at LANL, NASA, Puthoff's Institute, Wright Patterson, and ENECO
- Movies of Stenger's ball lightning experiments, lobby at PowerGen, lectures, Cutlass Submarine, plasma ball in a microwave chamber, cryogenic zero point energy experiments/index

Runs on any
computer with
a browser



\$19.95 No. America • \$23.95 Foreign
Order from: Cold Fusion Technology, Inc.
P.O. Box 2816 • Concord, NH 03302-2816
Phone: 603-228-4516 • Fax: 603-228-5975
<http://www.infinite-energy.com>

Lunar Energy

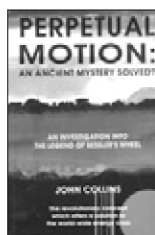
The oceans of Earth clearly demonstrate the Moon's pulling power but a group of German scientists believe it's also instrumental in encouraging the pulling of pints of beer.

A survey, spanning fifty new and full Moon cycles, carried out in Baden-Wurtemberg, revealed a distinct and regular increase in the number of drunk driving convictions on and around full Moon.

Student astronomers in Berlin were unconvinced by the survey's conclusions, but agreed to continue to mull over the data in the University bar for a while longer.

—Soo Seddon

PERPETUAL MOTION: An Ancient Mystery Solved?



\$25.00 No. Amer.
\$32.00 Foreign
Paperback

"The book deserves to be on many a history of science shelf, not only for the mechanical puzzle it poses but also for the timeless human story it tells..."

Dr. Thomas Phipps, Jr.

Cold Fusion Technology, Inc.
P.O. Box 2816, Concord, NH 03302-2816
ph: 603-228-4516; fax: 603-224-5975

EXOTIC RESEARCH REPORT



21st Century • Energy Technology
Alternative Medicine • Latest Inventions

U.S. \$30 • Can/Mex. \$35
Foreign: \$55

Exotic Research • P.O. Box 411 • Stanfield, AZ 85272
1-800-417-6399



Why not give *INFINITE ENERGY*
as a Gift Subscription?
Call 603-228-4516.

ence mandates that it is *especially important* to measure and observe phenomena that appear initially to contradict previous systematic relationships or "laws," or which appear not to be within the realm of present understanding of Science.

Walter Stacy, Chief Justice of the North Carolina Supreme Court, wrote in 1930: "There are those who feel more deeply over religious matters than they do about secular things. It would be most unbelievable if history did not record the tragic fact that men have gone to war to cut each other's throats because they could not agree as to what was to become of them after their throats were cut." True enough, and a warning to religious zealots. But today the high priests of Scientism, such as physicist Weinberg and APS flak Robert Park, are trying to "cut the throats" of all who disagree with their pseudo-religion. The good news is that Park and Weinberg will soon enter an age in which their arrogant disregard for basic principles of Science will be apparent to all. Perhaps in preparation they should reflect on Einstein's statement: "Science can only ascertain what is, not what *should* be."



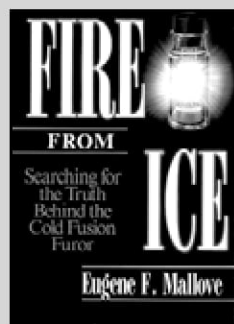
Miles continued from page 25

helping with the figures and manuscript preparations.

References

1. Fleischmann, M. and Miles, M.H. (to be submitted to ICCF-8, 2000).
2. Miles, M.H., Bush, B.F., and Stilwell, D.E. 1994. "Calorimetric Principles and Problems in Measurements of Excess Power during Pd-D₂O Electrolysis," *J. Phys. Chem.* **98**, 7, 1948-1952.
3. Miles, M.H., Park, K.H., and Stilwell, D.E. 1990. "Electrochemical Calorimetric Evidence for Cold Fusion in the Palladium-Deuterium System," *J. Electroanal. Chem.*, **296**, 241.
4. Miles, M.H., Bush, B.F., and Johnson, K.B. 1996. "Anomalous Effects in Deuterated Systems," *NAWCWPNS TP*, 8302, September.
5. Miles, M.H. 1998. "Electrochemical Calorimetric Studies of Palladium and Palladium Alloys in Heavy Water," *NEDO Final Report*, March 31.
6. Saito, T., Sumi, M., Asami, N., and Ikegami, H. 1995. "Studies on Fleischmann-Pons Calorimetry with ICARUS-1," *Proceedings of the 5th International Conference on Cold Fusion*, Monte-Carlo, Monaco, 105-115.
7. "The Icarus Systems: Isoperibolic Calorimetry: Acquisition, Research, and Utilities System. Icarus 2.00," 1995. *Technova, Inc.*, Tokyo, Japan.
8. Szpak, S., Mosier-Boss, P.A., and Miles, M.H. 1999. "Calorimetry of the Pd+D Co-deposition," *Fusion Technol.*, **36**, 234.
9. Domingues, D.D., Hagans, P.L., and Imam, M.A. 1996. "A Summary of NRL Research on Anomalous Effects in Deuterated Palladium Electrochemical Systems," *NRL/MR/6170-96-803*, January 9.
10. Miles, M.H. 2000. *J. Electroanal. Chem.* (Accepted for publication.)

*NAWCWD, Code 4T4220D, China Lake, California 93555;
e-mail: milesmh@navair.navy.mil; melmiles@ridgecrest.ca.us.



FIRE FROM ICE: Searching for the Truth Behind the Cold Fusion Furor

Eugene F. Mallove, Sc.D.

Infinite Energy Press Reprint
of 1991 Edition, Softbound
\$25.95 No. America
\$29.95 Foreign
(Includes Shipping/Airmail)

Cold Fusion Technology, Inc.
e-mail: staff@infinite-energy.com
web: <http://www.infinite-energy.com>
Phone: 603-228-4516 Fax: 603-224-5975

1999 Conference on Future Energy (COFE) Products

Proceedings (Paperback) \$40.00
Proceedings (CD) \$49.00

All plenary, workshop, and contributed papers. Fifteen audio tracks. Video clip of Intora Noncombustive Helicopter and clips from "Cold Fusion: Fire from Water." DOE-EIA twenty-year Energy Forecast and Radwaste study.

Video Tapes of Speakers \$20.00 Each

Speakers include: Ken Shoulders, Paul Brown, Kent Robertson, David Wallman, Paul Pantone, Peter Graneau, Thomas Valone, David Hamilton, Bruce Perreault, Steven Greer, Les Adam, Ed Storms, David Goodwin, Tom Van Flandern

Audio Tapes of Speakers \$5.00 Each

Speakers listed above

Audio Tapes of Workshops \$5.00 Each

Workshops include: Ken Shoulders, Gene Mallove, Jack Bitterly, George Miley and Bob Bass, Paul Brown, Bob Rose and Les Adam, David Wallman, Peter Graneau, Frank Znidarsic and Paul LaViolette, Paul Pantone, Ed Storms, Steven Greer



To Order: Cold Fusion Technology,
P.O. Box 2816, Concord, NH 03302-2816
Phone: 603-228-4516 Fax: 603-224-5975

Institute for New Energy

is an international organization to promote new and renewable energy sources. Its monthly newsletter is

New Energy News,

reporting worldwide on all facets of new and enhanced energy. Memberships in INE are \$35 per year for individuals, \$60 for corporations & libraries, and includes 12 issues of *NEN*

Journal of New Energy,

a Quarterly Scientific Journal, Hal Fox, Editor
Subscriptions are \$150 for 4 issues.

Fusion Information Center

3084 East 3300 South
Salt Lake City, UT 84109

Also available: *Cold Fusion Impact the Enhanced Energy Age*, a book about the near future of the world energy situation.

Phone for information: 801-466-8680
<http://www.padrak.com/ine/>



Subscribe to *Explore!*
for the Professional to
acquire the latest re-
search of

T.E. Bearden
P. Tewari
Robert Beck
G. Belovari

and other cutting edge
researchers interested
in Alternative Energy
and Energy Medicine.

Contact us at:
Explore Publications, Inc.
Post Office Box 1508
Mt. Vernon, WA 98273

sample issue \$7.50 (US)
back issues ARE available
credit card orders accepted
at 1-800-845-7866 or

visit our website at:
www.explorepub.com

Professional Service Directory

FREE Gift if you visit OURPAL website
<http://www.ourpal.com>



TM

PH:203-924-9538, FAX:203-924-9956

E-Mail: Ourpal@ourpal.com

Jail-Mail: 203-924-4271

(AKA Voice-Mail)

Snail-Mail: 7 Woonsocket Avenue
Shelton, CT 06484

Free Inventrepreneurship Kit

OUR PAL(R) ASIJA, MBA, PE, CDP, JD, ATM
AFFORDABLE Intellectual Property Attorney

Web Parlour Design

*"Helping to
weave you a
presence on
the Web."*

Web page design and site management services
provided for individuals and small businesses.

Email: info@webparlour.com

Web: www.webparlour.com • Tel. (603) 783-0034

Electrolysis Systems Power Control

Providing Consultation on Circuit Design and Operation; Programming to Your Specifications; Circuit and Software Prototyping. Marathon Systems is developer of the Mk12.30 Advanced Power Controller. Provides confidential consultation on operational requirements. Capabilities to design and test prototype circuits. Software programming.

Marathon Systems Enterprises, Inc.

P.O. Box 7743, Gaithersburg, MD 20898

Business Card Advertising: \$10.00
Size 2 1/4" x 1 1/2"
Classifieds: 50¢ per word

Classifieds

For Sale: Back issues of *Infinite Energy* Magazine. Five back issues (Nos. 1-27) for \$10.00 (North America Only). Contact *Infinite Energy* magazine: 603-228-4516 to request a highlights list or to place an order. Limited time offer! Ends September 1, 2000.

Transcription Service: Audio tapes of any length transcribed. Up to first hour of tape, \$15. Each additional hour, \$5. Video transcription also available. Call Christy at (603)228-4516 (8:30 a.m. to 5:00 p.m. EST) for more information.

Alexander V. Frolov's website about new energetics, antigravitation, and time rate control: <<http://www.geocities.com/a2509>>. For more information or to order a CD about experiments, contact <a2509@yahoo.com>.

BACK ISSUES OF
**INFINITE ENERGY MAGA-
ZINE** Always Available
Contact 603-228-4516
for Complete Listing

Volume 5—1999-2000

Issue No. 25 (88 pages) • Why Does Lightning Explode and Generate MHD Power (Peter Graneau) • Beamed Black Hole Radiation: Cosmology and Ball Lightning Connected • •The Pseudoscientists of APS • Experimental Study on Cold Fusion from Colombia • Excitation and Extraction of Vacuum Energy via EM-Torsion Field Coupling • The Source of Excess Energy from Water, Russia • Physical Laws of the Emerging New Energies, continued • Exploitation of Gravity Field Energy • Transistors and Cold Fusion: Part I

Issue No. 26 (72 pages) • James "Scotty" Doohan Interview • Conference on Future Energy • Unity Solid State Heat Engines • APS Features Cold Fusion Session • The Second Law of Thermodynamics and the Death of Energy • Deuteron Dimerization Inside Metal Crystals • Inside Zero Point Energy • The Perennial Challenge of Anomalies at the Frontiers of Science • Transistors and Cold Fusion: Part II • *Scientific American*, Fuel Cells, and Cold Fusion

Issue No. 27 (88 pages) • Do We Live in a Cold Fusion Universe? • Note and Update on "Thermo" Nuclear Fusion (Renzo Boscoli) • Three Decades of Cold Fusion Prior to Pons and Fleischmann • Is the Occurrence of Cold Nuclear Reactions Widespread Throughout Nature? • Producing Power by Burning Nuclear Waste • Deuterium Based Radiationless Cold Fusion • Nuclear Processes in Palladium Deuteride • A Review on Biquaternion Quantum Mechanics (E. Conte)

Issue No. 28 (72 pages) • The Tragedies of Renzo Boscoli and "Warm Fusion" • The Sun is Not a Hot Fusion Reactor (Harold Aspden) • A Visit to Hokkaido University • INE Symposium '99 • Mallove-Park Non-Debate • Review of Cold Fusion Theory • Alternative Catalysts for Cold Fusion • Vortex Filaments, Torsion Fields, and the Zero-Point Energy • New Segment: A Piece of History - Historical Opinions of Controversial Science • Book Reviews: *Forbidden Archaeology: The Whispering Pond, Is Anyone Out There?* • Robert Cook's CP Engine Test Impresses Engineers at Boeing

Issue No. 29 (72 pages) • On Electromagnetic Induction (Parry Moon and Domina Eberle Spencer) • Present Status of Chemically-Assisted Nuclear Reactions (Storms) • Prosaic Explanations: The Failure of UFO Skepticism • Carnot is Not Universally True • Amin Cycle Demonstrates Entropy Decrease • A Piece of History: Guglielmo Marconi • New Energy Named Top Trend • GEET Releases New Technology

Order Our New Specialty Products—See Inside Back Cover for Product Information



	North America	Foreign
T-Shirt	\$16.95	\$21.95
Coffee Cup, Infinite Energy	\$15.95	\$20.95
Coffee Cup, Quote	\$12.95	\$17.95
TOTAL:		

Use Order Form Below For Address/Payment Information

TO SUBSCRIBE OR RENEW *INFINITE ENERGY* MAGAZINE COMPLETE INFORMATION BELOW.

Name: _____
 Address: _____
 Address: _____
 City: _____ State: _____ Postal Code/Zip: _____
 Country: _____ Phone: _____ Fax: _____

If using Credit Card: Check one: Master Card _____ VISA _____ American Express _____

Card Number: _____ Expiration Date: _____

Signature _____ E-Mail address _____

Infinite Energy Magazine (ISSN 1081-6372)



Subscriptions are \$29.95 North America/\$49.95 Foreign for six issues per year.
 Any six single back issues \$29.95/\$49.95. Single Issues \$5.95/\$10.00.
 Special Double Issues \$10.00/\$15.00. Price includes First Class/Airmail shipping.

QUANTITY	ITEM #	PRODUCT	NORTH AMERICA	PRICE	FOREIGN
		NEW Subscription — Start at Issue No.			
		RENEW Subscription — Start at Issue No.			
		Single Back Issue(s) No.			
		Double Back Issue(s) No.			
		TOTAL			

Call *Infinite Energy Magazine* and ask for our catalog of books and tapes.

Cold Fusion Technology, Inc. P.O. Box 2816, Concord, NH 03302-2816
 Phone: 603-228-4516; Fax: 603-224-5975

Visit our website: [http:// www.infinite-energy.com](http://www.infinite-energy.com)

Now in its fifth year, *Infinite Energy Magazine* has been expanding distribution on U.S. newsstands. Typical 1999/2000 press run: 5,000 - 10,000 copies/issue. It is an international technical magazine with outreach to the general public as well. To maintain the highest editorial standards, it is written and edited by scientists, engineers, and expert journalists. It is aimed at pioneering scientists, engineers, industrialists, and investors who are entering an exciting R&D area. *Infinite Energy* now has subscribers in thirty-eight countries!

This area continues to grow explosively, with significant involvement by corporations and institutions in the U.S., Japan, France, Italy, India, Russia, and China. New technology developments and scientific discoveries are being made monthly. *Infinite Energy* reports on the latest information that is now pouring in from research centers around the globe.